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CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director GEORGE T. McCOY, State Highway Engineer H. C. ADAMS, Editor

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War Will Continue to Present Many Problems to Public Works Department During Year 1945

UNLESS the war comes to an abrupt conclusion, the Department of Public Works, in looking forward through 1945, must of necessity anticipate the same wartime problems which now confront it.

The Department of Public Works embraces the Division of Highways, Division of Architecture, and Division of Water Resources. These three agencies now are engaged in extensive postwar planning in conformity with the wishes of Governor Earl Warren. There will be a continuation of this work.

The war has created the major problems which have plagued the Department since Pearl Harbor. Drastic restrictions on new highway construction and also on the Governor's public building program have curtailed activities and the Department can not with any degree of confidence expect that these restrictions will be lifted during 1945.

The Division of Highways will have to confine itself to the maintenance of our highway system and to such new construction as may be desired by the Federal Government. The Division of Architecture will be limited to the preparation of plans for postwar building and construction or improvement of institutional structures which receive Federal Government approval for the use of critical materials.

The manpower shortage and the tremendous job of maintaining deteriorating roads and bridges are two of the problems which no doubt will continue to confront the Division of Highways during 1945. These, however, will not be permitted to interfere with postwar planning, which involves the preparation of plans and surveys and the acquisition of rights of way for an $80,000,000 highway construction program that will be ready for launching when war ends.

It is estimated approximately $19,000,000 will be available as of June 30, 1945, for postwar highway construction. In addition, it is estimated that about $15,500,000 will accumulate between July 1, 1945 and June 30, 1947, for construction purposes.

Time Now to Reappraise Entire Highway System

"The last general reappraisal of our highway system was in 1927. Since then our population has increased 66 per cent, our automobile registrations have doubled. The size and numbers of trucking and other commercial vehicles have increased enormously. The heavy flow of war materials is accelerating obsolescence.

"At your last session we appropriated 12 million dollars for plans, specifications, and rights of way, and before this session ends, preparations will have been completed for an 80 million dollar program of improvements.

This is progress.

But it would seem that this is the time for the Legislature to reappraise the entire system and make certain we are planning soundly for the future."

Excerpt from Governor Warren's Message to the Legislature.



Entrance to Public Works Building, Sacramento

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Budget allocations by the California Highway Commission for the 1945-1947 biennium are based on estimated revenues of $68,000,000 for the biennial period. The commission already has designated 116 postwar projects which can be undertaken when peace comes.

Motor transport, which is vitally essential to the entire economy of California, depends for its existence on good highways and is of such economic importance to our State that to permit its destruction would bring disaster, while to improve it is imperative for the proper development and expansion of California's vast economic resources. Hence the necessity for the postwar planning program of the Division of Highways.

The Division of Architecture will, during 1945, continue the planning of new mental institutions, college buildings, correctional institutions, office buildings, State veterans' hospital expansions, and other State buildings, and will also continue the preparation of a wide program of reconditioning and repair to existing buildings.

The emergency repair and replacement of deteriorating buildings and equipment has been during the past year, and will continue to be during 1945, a major problem of both manpower and materials.

The money to pay for the postwar building program has accumulated in the treasury for this purpose as a result of the sound tax and fiscal policy of Governor Warren.

Some $72,000,000 of the funds accumulated and earmarked are for State buildings and of this sum $33,000,000 have been authorized by the Department of Finance and the State Board of Control. The completion of the planning of this postwar construction will be the major project of the Division of Architecture during 1945.

The Division of Water Resources will continue through 1945 as it has done for many years, its cooperative work with the Federal Government in connection with the Central Valley Project and the State Water Plan.

District VII Builds 22 Access Roads as Part of Its War Effort

By S. V. CORTELYOU, District Engineer

DECEMBER 7, 1941, found District VII with a fairly large program of construction work under contract and in a relatively short period after this date 54 engineers of varying grades left the district staff for the armed services of the United States.

At this time we were asked to undertake the construction of two flight strips, one in Ventura County and one in the metropolitan area. Due to Army requirements of approach clearances to these flight strips their location was a difficult problem. However, it was found possible to locate one not far from San Pedro in an extremely strategic position, yet on land which was not occupied by any improvements. It is assumed that the veil of censorship is not yet entirely lifted from this work; so no description of the size of the flight strips nor their exact location will be given.

HEAVY EXCAVATION

The flight strip in Los Angeles County involved the moving of 174,227 cubic yards of roadway excavation and the importation of 193,703 cubic yards of select material. The runway on this strip was given a base of cement-treated imported borrow with a plant mixed surface. This flight strip has been in constant use since its completion and has successfully carried far heavier wheel loads than were called for in the design.

The flight strip located in Ventura County was also located upon land on which there were no improvements although some walnut trees had to be removed to provide the required approach clearances. This flight strip involved 44,269 cubic yards of roadway excavation and the importation of 215,241 cubic yards of selected material. The base for the runway on this strip was composed of bituminous treated selected material. The runway was surfaced with plant mix. This flight strip also has been in almost continuous use as a training field.

The aggregate cost of these two flight strips was $683,000.

TWENTY-TWO ACCESS ROADS

The district has also been called upon to construct 22 access road projects, with a combined length of 36 miles, at a total cost of $1,408,000.

These are about evenly divided between war plants and military establishments. The Public Roads Administration engineers have kept in mind at all times their formula that access roads should be designed on a standard which would make them just sufficient to carry the wartime traffic. With this requirement to consider, the bulk of the access road construction in this district has been plant-mixed surfacing on a crusher run base, the plant-

Looking easterly on Kenmere near Lincoln in Burbank, Los Angeles County, after improvement





Upper—This view was taken at Kenmere, looking northerly on Buena Vista in Burbank. Center—View looking southerly on Buena Vista south of Kenmere in Burbank. Lower—Imperial Highway looking east from Sepulveda Boulevard. Los Angeles Municipal Airport is on the left



Upper—View of improved Imperial Highway looking east from Isis Avenue. Lower—Figueroa Street looking north from C Street in Wilmington, Los Angeles County

mixed surfacing being in general three inches thick and the crusher run base varying in thickness, depending on the bearing value of the native soil underneath.

This type of construction has proved very satisfactory for the war period as it requires a minimum of hand work and it has been found possible to obtain a fairly good job without many experienced workmen. So far it has proven adequate for the traffic for which it was designed. Another advantage of this type of construction is that it takes much less elapsed time for its completion and, therefore, lessens the period of tie-up of the road in the very vital traffic areas in which these roads have been constructed.

NECESSARY DELAYS

In spite of the simple type of construction which has been applied to the bulk of these access roads, the period which has had to elapse between the certifying of one of these roads for construction by the Public Roads Administration and the time the project could be let to contract has been considerable. One of the reasons is that in many cases new rights of way had to be obtained. In addition, the projects were almost all inside city limits and the improvement had to be correlated with the existing city improvements and be approved by city engi-

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Wartime Road Construction in District I

By A. M. NASH, District Engineer

RESTRICTIONS on highway construction, resulting from the National Defense Program, and later by the declaration of war in 1941, made only those projects essential to the war effort eligible for approval for construction. At the same time it was imperative that the strategic highways and their bridges be maintained in a suitable condition to carry military and civilian traffic without hindrance.

As a consequence of these governmental restrictions, highway construction in District I since 1942 has been divided into the following three distinct classes of work:

1. **Construction required by the Military for access to their establishments.**
2. **Construction required to repair strategic highways and protect them from deterioration.**
3. **Construction necessitated by detouring weak bridges or their replacement with new structures.**

ARCATA-EUREKA HIGHWAY

In Class 1 was a project financed by the Federal Government, planned and constructed by the District during 1942 and 1943 at a cost of $351,669.75 for providing a modern highway from Route 101 at Arcata to the Eureka Section Base on Humboldt Bay. The cost of surveys and plans for this project was provided by Humboldt County.

Primarily, construction of the new highway was to insure a traversable road at all times for the Military due to the failure of the lightly constructed county road which had deteriorated to such an extent from heavy truck hauling that in places the road had become almost impassable. This road had a further important function in that it provided access to the redwood lumber manufacturing town of Samoa, where are located the largest mills on Humboldt Bay.

After the war the highway will also afford easy access to recreational areas comprised of the ocean beaches of the Samoa peninsula as well as to the U. S. Coast Guard facilities located near the tip of the peninsula.



Grading a line change on north bank of Smith River, Del Norte, to by-pass a weak timber bridge

which have been maintained at this location for many years.

NEW ALIGNMENT REQUIRED

Construction involved the grading and surfacing of 3.61 miles of highway on entirely new and modern alignment and grades, to replace about 4.5 miles of failed county road, together with the widening and resurfacing of 5.87 miles of narrow county road, and the grading and surfacing of 1.55 miles of modern highway partly within the limits of the Government Naval Reservation to replace an obsolete and narrow one-way road. In addition to the road work, two new timber bridges were constructed and two widened and strengthened, the longest of these having a length of 491 feet and spanning Mad River Slough at the northerly end of Humboldt Bay.

The major items of work involved 94,848 cubic yards of gravel base, 14,644 tons of aggregate for plant mixed surfacing, 850 tons of asphalt, and 216 MBM of redwood and fir timber piles for bridge construction. Because of the shortage of reinforcing steel for use in concrete, 4,748 lineal feet of old railroad rail was used for this purpose.

FIFTEEN MAJOR CONTRACTS

Major construction activities in District 1 since 1942 have been in Class 2, and in part have necessitated the award of 15 contracts for repairing 85.537 miles of highway at a cost of about $748,250. These 15 contracts have been, in general, for the placing of base reinforcement in the minimum amount for duration traffic requirements, and a wearing surface of bituminous treated aggregate.

This sizable expenditure for highway surface repairs is the result of the unique position occupied by District 1 in respect to the war effort. Mendocino, Humboldt, and Del Norte counties, comprising the northerly coastal area of the State, and of District 1, are the three major redwood timbered areas in the world, with their saw mills, large and small, producing, during 1944, an estimated 2¼ million feet of lumber daily. These three counties are also a well-known recreational area traversed from north to south by the famed Redwood Highway along which are many State-owned parks readily accessible to tourists.

TIMBER INDUSTRY

Since 1941 the timber industry has been producing redwood lumber at a capacity limited only to that possible with available labor. Numerous small mills have been erected along the railroads and highways in an endeavor to supply the insatiable demand of war for lumber. The products of these small mills, as well as the old established firms, are cut from logs hauled largely by trucks over the highways from the forests to the mills. After the lumber product has been manufactured, it is either shipped by rail, or by large transport trucks to water transportation for transshipment to all part of the world occupied by the Allied armies. It is estimated that approximately 450

million feet of logs and lumber are hauled yearly over the roads in District 1, and this converted to weight represents nearly 1½ billion tons of freight.

This hauling operation of a product recognized as of the highest priority in the war effort, in conjunction with the hauling of materials for use in the construction of defense establishments, caused sections of highways, primarily designed as recreational roads, to develop failures. As these progressed from further heavy hauling, inducing a frequency of load repetition ordinarily associated with industrial areas, it became imperative that repairs of sufficient adequacy be made to last for the duration.

ROAD FAILURES

Two of the 15 contracts awarded for repairs to 14.27 miles of highway at a cost of over $92,000 were directly the result of heavy truck hauling of materials incidental to construction of airports essential to coastal defense. The Federal Government has recognized a responsibility for this class of failure and claims are pending to secure reimbursement of the State's expenditure for the work accomplished.

Base reinforcement used on these repair contracts has been, in general, of screened river gravel graded from 2½ inches to dust for the bottom courses, and from 1½ inches to dust for the upper 3 inches. The amount of binder material was purposely kept to the minimum, and bases placed with as little as 3 per cent of 200 mesh material were satisfactorily compacted with little difficulty being experienced in maintaining the base prior to placing of the prime coat.

PROBLEMS MET

One of the disadvantages of the dense graded plant or road mix surfacings in this coastal area of heavy rainfall, has been the tendency of the pavement to become unstable during the summer season following construction. From all indications this is caused by intrusion of moisture into the pavement from the road surface, or from the subgrade through capillary action. Whatever the source, the moisture in or under the pavement is forced to the surface by higher temperature, and this causes an unstable pavement, with the bituminous binder (particularly road oils and cut back asphalts) flushed to the surface.

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Upper—Narrow road used as detour around weak bridge on U. S. Route 299 by heavily loaded logging trucks. Center—Type of road obtained by Humboldt County through reconstruction. Lower—This illustrates another type of road obtained by county after improvement

George Bartlett Award Bestowed Upon C. H. Purcell

DIRECTOR of Public Works C. H. Purcell returned from the annual convention of the American Association of State Highway Officials held this year in Cincinnati, Ohio, with the coveted George S. Bartlett Award.

Mr. Purcell is the 13th recipient of this honor, which is "conferred annually upon some individual who has made an outstanding contribution to highway progress," by a three-member board of award made up of the presidents of the American Association of State Highway Officials, the American Road Builders Association and the Highway Research Board of the National Research Council.

The first award was made in 1931 to Thomas H. MacDonald, Chief of the U. S. Public Roads Administration. No award was bestowed in 1940.

The 1944 Board of Award consisted of Stanton Walker, President, Highway Research Board, Chairman; Samuel C. Hadden, President, American Association of State Highway Officials; Carl Brown, President, American Road Builders Association.

Dr. L. I. Hewes, Chief, Western Region, Public Roads Administration, introduced Mr. Purcell when the award was made. Dr. Hewes said:

"On this occasion of the conferring of the George S. Bartlett Award to Charles H. Purcell, it is my honored privilege to introduce him to the presiding officer.

"This award goes annually to a man who has made outstanding contribution to the advancement of American highways. So it is highly fitting to state briefly some of the achievements which measure his outstanding contributions. You should understand his qualities and his dimensions. He is well known to me, and I wish to emphasize first his persistent loyalty to his profession, his superiors and his subordinates. These qualities have helped him to accomplish unusual objectives.

"Mr. Purcell is a graduate of Nebraska, and also attended Stanford. After some unusual experiences as a young engineer in Wyoming, Nevada, Peru and Oregon, we find him in 1916 as Bridge Engineer for the Columbia River Highway Project.



"On January 1, 1918, I selected him as Bridge Engineer for the Public Roads Administration district at Portland, Oregon, and in 1919 recommended that he become District Engineer there. The district consisted of Oregon, Washington, Idaho, Montana and Alaska. He held this position for 10 years.

"In 1928 he was asked to become State Highway Engineer of California. In 1933, in addition to the State Highway Engineer's duties, he became Chief Engineer of the 75-million dollar San Francisco-Oakland Bay Bridge. This seven-mile highway bridge and approaches presented some of the most difficult problems that ever confronted an engineer. It ranks among the most important and successful structures of the world. It now operates as a great express highway with a traffic of 50,000 vehicles daily. Its contribution to our war effort is incalculable.

"After 15 years as State Highway Engineer, during which time he super-

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CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

Mission San Gabriel Arcangel September 8, 1771

RESPONDING to a petition from Father Junipero Serra, Viceroy Carlos Francisco de Croix in the fall of 1770 sent from his Mexican headquarters permission to establish in California the fourth of the Franciscan missions. The new station was to be under the patronage of St. Gabriel, the Archangel, and Fr. Serra and Captain Pedro Fages, the military commander, decided to locate it near the Rio de Nombre de Jesus de los Temblores (River of Earthquakes), a name given to the Rio de Santa Ana when the Portola expedition of 1769 camped upon the banks of that stream.

This mission, founded on September 8, 1771, and named San Gabriel Arcangel, was near a site that later became the City of Los Angeles, and was to be one of five situated about one day's travel apart north of San Diego.

Two padres, Fr. Pedro Benito Cambon and Fr. Angel Somera, were chosen to build the new mission, later known as "Pride of the Missions"; and on August 6, 1771, with a guard of 10 soldiers, these two marched out of San Diego. In view of the tragic events that came to pass at San Gabriel, due to mistreatment of the Indians by brutal Spanish soldiers, it is interesting to read Father Francisco Palou's account of the founding of the mission as given by Fr. Zephyrin Engelhardt, historian of California missions.

SAVAGES ARE IMPRESSED

"They traveled toward the north," says Father Palou, speaking of the priests and their military escort, "on the road taken by the expedition of 1769. After marching about 40 leagues, they arrived at the Rio de los Temblores. Just as they were deliberating about the choice of a site, a great multitude of savages, armed and headed by two chiefs, appeared and with frightful yells attempted to prevent the founding of the mission.

"Fearful that a battle might ensue and that some might be killed, one of the Fathers produced a canvas picture of Our Lady of Sorrows and put it in view of the savages. No sooner had he done this than all, overcome by the sight of the beautiful image, threw down their bows and arrows. The two chiefs quickly ran up to lay at the feet of the Sovereign Queen as tokens of their greatest esteem the beads they wore on the neck. By the same action they manifested their desire to be at peace with us. They called upon all the neighboring rancherias who in large numbers flocked together, men, women and children, and came to see the Most Holy Virgin. They also brought seeds, which they left at the feet of the Most Holy Lady, imagining that she would eat like the rest."

Father Palou records that "the sight of the image of our Lady transformed the savages around Mission San Gabriel so that they made frequent visits to the Fathers" and, following the first holy Mass celebrated under the shelter of boughs on September 8th, assisted the padres in building a chapel, buildings and stockade.

INDIANS AND SOLDIERS CLASH

With such an auspicious beginning toward mutual understanding it is a pity that the very soldiers sent to assist the priests should have been the ones to undo the good work done by the missionaries. Just when the Indians were going in large numbers to Mission San Gabriel, one of the soldiers outraged the wife of one of the chiefs and, in an ensuing clash between the natives and armed guards, the chief was killed. For a long time the Indians remained away from the Fathers and it was not until the offending soldier was transferred to Monterey that their confidence in the padres was restored.

This incident, Fr. Engelhardt claims, delayed the founding of Mission San Buenaventura for 12 years, Commandante Fages fearing to send any soldiers from San Gabriel north to assist in establishing another missionary station.

Visiting San Gabriel in September, 1772, Father Serra was delighted to find that a number of Indian children had been baptized, including the small son of the slain chief, but excesses being committed by the soldiers against the natives caused Junipero personally to complain to the Viceroy of Mexico, with the result that the military commander of California was specifically ordered to cease all interference with the padres and their neophytes.

CAPTAIN ANZA ARRIVES

Routine of San Gabriel was interrupted on March 22, 1774, by the ar-

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into northern Washington.

Present day State highways lead to all the mission sites. When the war is ended and California again welcomes tourists from all over the world and there are no longer restrictions on automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways will publish in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions will be taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the third of the series.

Mission San Gabriel Arcangel turned over to the "Missionary Sons of the Immaculate Heart of Mary" in 1908 and which has been beautifully restored

Ancient grape arbor of Mission San Gabriel Arcangel. Photo by Byron Dome



rival of Captain Juan Bautista Anza and the weary and hungry members of his expedition who, after many hardships, had found their way from Sonora, Mexico, to the mission in carrying out instructions to locate a route from Sonora to Monterey. They crossed the Sierra through San Jacinto Pass. Discovery of this overland way led Viceroy Bucareli the following year to send out a new expedition from Sonora whose purpose was to found a presidio, mission and colony at San Francisco.

For two years Mission San Gabriel occupied itself more or less serenely with its spiritual and temporal work and then in 1776 the establishment was removed to its present location and construction of new buildings undertaken. In 1796 the small chapel was replaced with a larger church which, in turn, in 1800 was superseded by the existing building of stone, mortar and brick. In that year there were 1,078 neophytes at the mission, 1,953 had been baptised, 869 had been buried and 396 couples had been married.

In 1776, Father Serra stopped at the mission on his way from founding



Old Mission bells of San Gabriel. Photo by Byron Dome

the Mission San Juan Capistrano and records disclose that he baptized an Indian child there on December 11th of that year. Two years later, November 4, 1778, Junipero confirmed at the mission for the first time.

NEW TROUBLES

New troubles with the natives began in 1779 when Governor Felipe de Neve, an enemy of the missions, decreed that convert Indians at every mission should annually elect two alcaldes and two regidores or councilmen and vest them with control of the neophytes. Unfitted for self-government, the San Gabriel Indians become insolent to both the priests and soldiers. And then in July and August, 1781, two contingents of soldiers and settlers arrived from Sonora and from then on, throughout the founding of the pueblo of Los Angeles, there were frequent clashes between the padres and the Indians on the one hand and the soldiers and settlers on the other.

At the age of 68 years, Father Serra made a trip from Monterey to San Gabriel in February-March, 1782, to discuss with Governor Neve the founding of Mission San Buenaventura and Mission Santa Barbara and on his way back north after a second visit in October, 1783, he officiated at 233 confirmations at San Gabriel, bringing the number of persons confirmed there by him to 866. By the year 1790, San Gabriel surpassed all missions in livestock and farm products and was second only to San Antonio in the number of neophytes.

An earthquake in 1804 did considerable damage to the new church and mission buildings, but construction proceeded steadily in spite of more or less continuous disputes between the padres and settlers over mission and Indian lands and increasing maladies to which the Indians fell heir as a result of association with the colonists. An incipient revolt among the natives was quelled in November, 1810.

EARTHQUAKE DOES DAMAGE

The earthquake of December 8, 1812, demolished the church tower and did other damage, but the priests made repairs and continued their building program, completing a hospital in 1814. In 1813 the neophyte population was 1,600.

With the aid of the San Gabriel padres and their Indians, the pueblo of Los Angeles was enabled to build the Church of Our Lady of the Angels, which stands today in the center of the city of Los Angeles. It was completed about 1822.

From 1821, when Mexico declared her independence and California became a part of the new republic, San Gabriel suffered as did the other Franciscan missions from oppression by a long line of successive political regimes culminating in secularization and confiscation of the mission in 1834. San Gabriel was especially victimized by Governor Echeandia, who levied upon the mission for many thousands of dollars, provisions and farm products for the soldiery. Governor Michelotorena's action in returning San Gabriel to the Franciscans brought only a brief respite to the padres for when Pio Pico became Governor their troubles multiplied. On June 8, 1846, Pico sold the mission to Hugo P. Reid and William Workman. A month later, the American flag was raised in Monterey, too late to save San Gabriel from the destruction wrought by greedy Mexican politicians. President Lincoln returned San Gabriel to the Catholic church in 1865.

Self-sacrificing padres carried on at San Gabriel caring for the few Indians left in the vicinity until 1908, when San Gabriel was turned over to the "Missionary Sons of the Immaculate Heart of Mary," an order that was founded in Spain in 1849. The old mission has been beautifully restored and its activities increased greatly during the last three decades.

Motorists desiring to visit San Gabriel from Los Angeles should proceed from the downtown section of the southern Metropolis out North Broadway to Huntington Drive, keeping on the left hand side of the road which leads into the community of Alhambra. At the eastern limits of Alhambra the visitor should turn right at Mission Road and proceed two blocks to the mission.

San Gabriel also is reached via the Pacific Electric Railway from Los Angeles city points. Directions may be obtained at the Pacific Electric Depot, Sixth and Main Streets. The distance from the heart of downtown Los Angeles to the mission is about 12 miles.

San Fernando Rey de Espana
September 8, 1797

THAT zealous padre and devoted friend of Father Junipero Serra, Fr. Juan Crespi appears, in the light of history, to have been gifted with a divine intuition in the matter of unerring judgment in the selection of mission sites. He discovered several of them.

Marching from San Diego to Monterey with Gaspar de Portola's expedition in 1769, Fr. Crespi looked with the eye of a missionary upon the Valley Encino where, on August 5th of that year, Portola camped with his forces. The priest wrote to Father Serra that the site was an excellent one for a Franciscan station.

In August, 1795, Fr. Presidente Fermin Francisco de Lasuen dispatched an exploring party from Mission San Buenaventura with instructions to locate a suitable spot for a mission between that point and Mission San Gabriel, near Los Angeles. This and subsequent parties made exhaustive explorations and recommendations, but in the end it was found that Encino Valley, first come upon by Father Crespi, and named by him Santa Catalina de Bononia de los Encinos, was the best location. And there Father Lasuen decided to build Mission San Fernando Rey.



The arches with their columns of San Fernando's arcade form one of the many beautiful attractions of the mission

FATHER LASUEN FOUNDS MISSION

The Fr. Presidente of the California missions was 75 years of age in August, 1797, when, with Sergeant Ignacio Olivera and five soldiers, he set out from Mission Santa Barbara to establish San Fernando Rey, fifth in geographic order of the Franciscan missions on El Camino Real, but seventeenth in sequence of founding.

For clarity and conciseness, Father Lasuen's report to Governor Borica on the establishment of San Fernando Rey is a literary gem. It is in the Santa Barbara Mission Archives and as published by Father Engelhardt, mission historian, is worthy of repetition here. It follows:

"Viva Jesus!

"Senor Governador—My dear Senor: I have the happy satisfaction to communicate to Your Honor that today the solemn feast of the Nativity of Mary Most Holy, on this suitable spot called by the natives Achois Comihabit, between the Missions of San Buenaventura and San Gabriel, with the assistance of the Rev. Fr. Francisco Dumetz, destined for this Mission, of the troops assigned to guard the new establishment, and in the presence of many pagans of both sexes and all ages, who manifested a good deal of pleasure and satisfaction, I blessed the water, the site and a large cross, which we planted and venerated. I concluded the function by solemnly singing the Te Deum. Having finished this, in the same little arbor in which I celebrated the holy Sacrifice of the Mass, I blessed the Baptismal Font and then baptized those offered. Thanks be to God! Thus we took possession of the site by dedicating it in honor of the glorious San Fernando, King of Spain, and in this manner beginning the Mission under that sacred title in conformity with the orders of His Excellency, Marquis de Branciforte, Viceroy of New Spain, and with those of Your Honor. God our Lord keep Your Honor in His holy Grace many years. Mission San Fernando established September 8, 1797. Fr. Fermin Francisco de Lasuen.—To Col. Com. Don Diego Borica."

INDEFATIGABLE SPIRIT

The unquenchable spirit of Fr. Lasuen is revealed by ancient records which show that in June, 1797, he left Mission San Carlos de Monterey, established the Mission San Jose north of the City of San Jose in what is now Santa Clara County on June 11th; marched to a place about 15 miles east of what now is Watson-



Mission San Fernando Rey de Espana as it looks today to the visitor entering its hallowed precincts

ville and founded the Mission San Juan Bautista on June 24th; turned south and on July 25th on El Camino Real established Mission San Miguel, and then trudged on into the south to found San Fernando on September 8th.

Fr. Lasuen was proud of the fact that he baptized an Indian child on the same day that he created Mission San Fernando and recorded the event in these words: "So on the spot, in the same little arbor in which I had celebrated the Holy Sacrifice of the Mass, I blessed the baptismal water and solemnly baptized Fernando Maria, about four years of age, called in paganism Coyohuoch, son of Mayso and of Chemayo, from the rancheria of Aichoicominga."

It would appear that the first mission church of San Fernando, a small adobe building, was blessed on November 28, 1797, for on that date there appears in the old mission records a notation that the forty-third baptism took place therein, all other baptisms having been solemnized in the "little arbor."

CONSTRUCTION RAPID

Construction of buildings at San Fernando, granaries and abodes for the priests, Indians and soldiers proceeded rapidly and in 1799 a new church edifice was erected. In 1804, 70 additional adobe houses for the neophytes were built. The number of converts was almost 1,000. The year 1806 saw the completion of a newer and grander church, more granaries, a tannery and other structures. "The Mission of the Valley," as San Fernando Rey was known, was prospering.

This photograph taken more than a decade ago shows old walls of Mission San Fernando before reconstruction. Photo by Byron Dome





Worshippers and tourists alike find the old San Fernando Mission gardens, now a public park, as delightful as this photograph indicates them to be

Visitors to San Fernando Rey are greatly impressed by the unique long building 243 feet in length known as the "House of the Fathers." Old records show reports of progress in its construction beginning in December, 1810, and running to December 31, 1822, on which date Father Francisco Gonzales de Ibarra reported its completion after twelve years labor.

Poor Father Ibarra! The story of his devotion to San Fernando Rey and its Indians is a pathetic one. He saw the mission in its wonderful golden years and during the evil years of its deepest despair preceding its confiscation by Governor Pio Pico.

The revolt of Mexico against Spain starting in 1810 brought misery to San Fernando Rey as well as the other California missions. From 1811 until the end of the missionary period, San Fernando was compelled to support the idle soldiers and their families, furnishing food, clothing and pay. From 1822 to 1827, San Fernando contributed to the Santa Barbara presidio alone supplies amounting to $21,203.

All money and supplies for the military had to be produced by the Indians of the mission and payment was enforced over the vigorous protests of Father Ibarra.

The Indian converts became virtual slaves of the soldiers and Mexican politicians. The latter, led by Governor Echeandia, coveted the mission lands, which they and their successors finally obtained by theft and fraud.

The earthquake of 1812 caused considerable damage to the mission and buildings, but repairs and reconstruction were undertaken immediately. In 1819 there were 1,080 neophytes enrolled and in spite of military and political oppression, San Fernando Rey was in a prosperous state.

Preparatory to seizing the missions, Echeandia demanded from Fr. Ibarra in 1827 an inventory of all lands and property and that inventory showed, among other things, that the mission possessed 6,000 head of cattle and 8,000 sheep. In that year, Echeandia announced a plan to make San Fernando Rey a pueblo, emancipate the Indians and designate the missionary in charge as pastor of the natives. He failed in this.

MISSIONS CONFISCATED

Four years later Manuel Victoria was sent to California as Governor and was endeavoring to help the Francis-

(Continued on page 20)

Bridge Maintenance Practice On California Highway System

By MERLE H. GODWIN, Associate Bridge Engineer

THERE are 4,636 bridges on the California State Highway System omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is 125,000,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenance and Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the second. It deals with Repairs and Replacements to Bulkheads and Abutments.

AS stated in the previous article, the total number of timber bridges on the California State Highway System is about 1,500 and these structures represent a replacement value of approximately $10,000,000 out of a total bridge value of $125,000,000. About 1,000 of these bridges have timber bulkheads, the rest being mostly of concrete; therefore, some 2,000 timber bulkheads must be maintained.

Assuming an average replacement cost of $1,000 for each bulkhead, their value would be about $2,000,000. It is thus evident that the maintenance and replacement of timber bulkheads is a sizeable item. This article covers some of the troubles encountered in this work and the methods employed by the Bridge Maintenance Section in maintaining such portions of a timber structure.

Concrete abutments give very little trouble, that which does occur being chiefly confined to settlement, mostly due to scour. Such trouble is not necessarily peculiar to type of material but may occur in timber construction as well as in other types. Correction of settlement will be covered in a subsequent article to appear shortly.

OLD COUNTY BRIDGES

A considerable portion of the timber construction found on California Highways was inherited from the counties at the time the roads were taken into the State system. The balance was built by the State, some of which is of untreated timber, a type made necessary at a time when funds were limited or a temporary type of construction was justified. Maintenance of these structures has been heavy, especially for those portions in direct contact with the soil, such as bulkheads. Treated timber has been used where a more permanent type of construction was desired. Such timber has given little trouble and satisfactory results have usually been obtained.

Under different climatic conditions similar types of construction show wide variations in service life or maintenance costs and a type of construction proving economical for one section of the State might not prove so for another. In the damp coastal regions, untreated timber has a short service life, whereas in the drier valley and foothill regions this kind of construction has given fair service.

As noted in the previous article the superstructure is a rather vulnerable part of the bridge, being subjected directly to heavy live load concentration. Bulkheads are also very vulnerable, being exposed not only to the high stresses above noted, but in addition, to the erosive action of the stream and its burden as well as to the troubles developing from contact with the earth. Other and more serious troubles in such portions of a structure are shrinkage, checking, and decay; the latter being especially destructive to timber bulkheads.

IMPACT EFFECTS

Impact effects are generally made evident by crushing of the caps either between stringers and piles or directly over the pile tops. **(Photo No. 1.)** If not due to a weakness in design, it is a result of decay in cap or pile tops. Sealing out the moisture by painting contact surfaces with wood preservative or covering pile tops with an impervious membrane such as treated fabric or sheet metal is effective and prolongs the service life. Sometimes moisture gets into such places because of inadequate design of floor system directly over the caps. Every effort should be made to secure as watertight construction as possible at this location and an impervious sheet **(shown in Fig. B)** is effective in either stopping or reducing such inroads to reasonable amounts.

Scour damage caused by the erosive action of the stream can be minimized by proper penetration of piling, lowering of the grillage and backwalls to a safe level or by several other protective measures commonly used. Damage due to erosive action working directly on the piling at ground line levels can be corrected or prevented by several methods. Details covering such work will appear in a subsequent article dealing with pile protection and repairs. Decay at this point can only be satisfactorily prevented by the use of treated piles or posts or by replacement using one of the methods shown below.

SHRINKAGE UNAVOIDABLE

Shrinkage in some degree is unavoidable in exposed structures such as timber bridges. Use of solid bridging between stringers and directly over the abutment caps, if placed with grain vertical and cut to length equal to depth of stringer, will cause trouble, since shrinkage in this bridging is



less than in the horizontally grained stringers.

The differential shrinkage will force the flooring upwards, break up the surfacing, and with the admission of moisture, hasten decay. This may be avoided either by cutting vertical grain pieces in lengths shorter than stringer depth, placing the grain horizontally or by using herring-bone bridging. Better still is the use of dowels from stringer to cap as a substitute for bridging. **(Fig. D.)** Checking of timber in treated or untreated piles or dimension members admits water and encourages decay. Spraying of checks with a wood preservative may sufficiently improve conditions to justify the cost; however, it is not an entirely satisfactory solution and the condition is one which is difficult to handle.

FUNGI GROWTH

Development of rot requires the presence of decay fungi with suitable conditions of moisture, temperature, and air. The lack of any one of these three conditions will inhibit decay. Complete control of any one of these in an exposed structure such as a timber bridge is practically impossible. It is possible, however, to limit them sufficiently to secure a fair degree of service. Wood continuously wet or continuously dry (below 20%) will not decay. However, if alternately wet and dry or with moisture content at the right amount (generally somewhat above and near 20%) temperature and air being favorable, decay will be rapid.

Timber in contact with earth is generally exposed to conditions conducive to fungi growth. To prevent or limit this growth, such timber should be protected as much as possible from changes in moisture content. This protection can be furnished in some degree by using proper construction methods. Once decay has started, repairs or replacements as indicated herein are eventually required.

Contact surfaces are locations which are favorable to the collection of moisture and encourage growth of fungi. They are thus vulnerable locations and weak points in timber bridge construction if proper steps are not taken to protect them in all ways possible.

In timber bulkheads such surfaces are found between the following members: (1) bulkhead planks and approach fill, (2) stringers and flooring, (3) stringer ends and bulkhead planks, (4) stringers and top of caps, (5) top of piles or posts and caps, (6) caps and bulkhead planks, (7) piles or posts and bulkhead planks. Correction of trouble due to decay at these locations is often difficult and expensive. **Photos 1, 2, 3, and 4 show several such surfaces where decay has developed, and figures A, B, C, and D show several methods employed in correcting these troubles.**

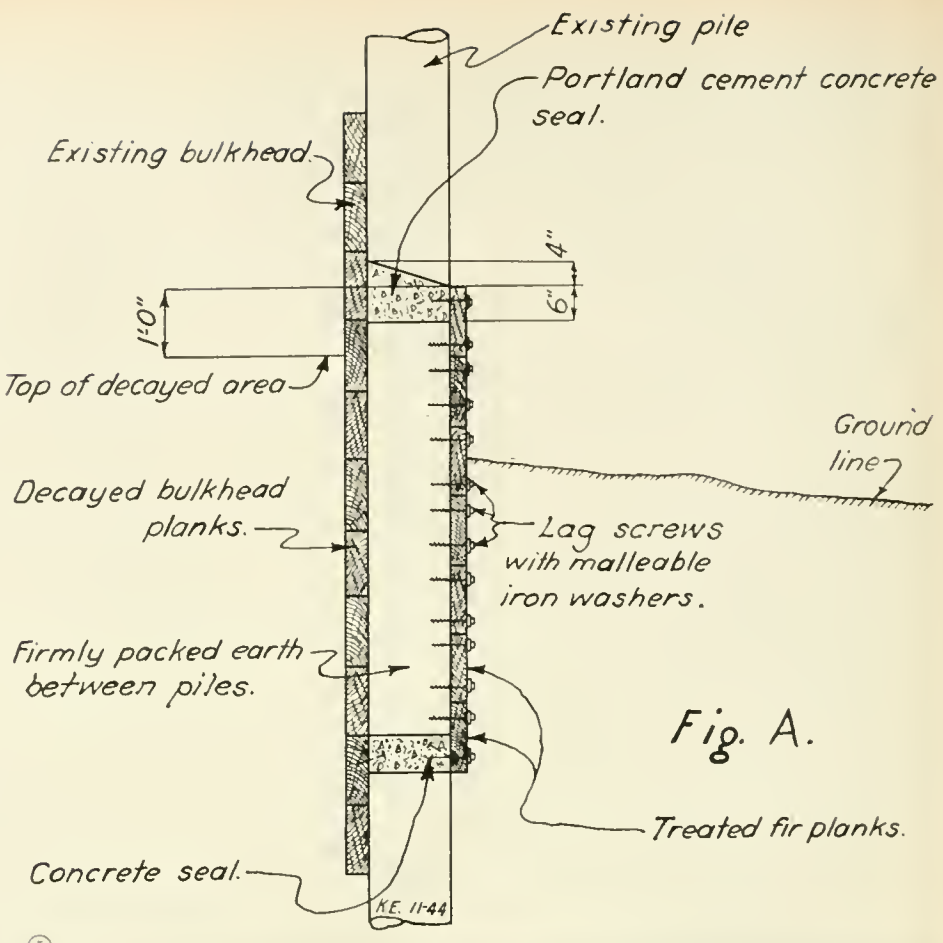


Fig. A.

⑤



PROPER DESIGN REQUIRED

Much of this trouble can be eliminated or reduced in the original construction by proper design. Painting of all contact surfaces with two coats of wood preservative seals out the moisture to a large extent and yields increased life at small cost. Complete painting of all sides of a timber member without definite knowledge of moisture content may do more harm than good. If moisture content is favorable to fungi growth, sealing will accelerate this growth and decay will progress more rapidly than would have been the case had no paint been used at all.

Bulkhead planks, if untreated, can be effectively and cheaply protected by placing building paper between them and the approach fills. Generally, two layers of paper should be used and each layer should be well brushed with an application of tar or asphalt. Treated timber in this location gives satisfactory service.

Weakness due to decay in bulkhead planks of an existing structure can be corrected by the method shown in Fig. A. **(Photo No. 5.)** After excavating to the desired depth treated planks are lagged onto the outer faces of existing piles or posts and the space between old and new planks is then filled with sand. This is an effective and economical way of substituting for such decayed planks, especially where a limited life remains in the piling. Cost of such work has run around $1.00 per square foot of surface area of new planks. Several variations revolving around this general idea have also been used.

DECAY CAUSES LOOSENESS

Decay occurring between stringers and flooring directly over caps will cause looseness at this point; surfacing fails and with the admission of moisture, decay is rapid. To avoid such conditions, an effective membrane discussed above and shown in **Fig B**, can be placed. If decay has progressed to a marked degree, more drastic measures must be taken. Conditions permitting, a supplemental timber bent could be constructed in front of the old one, the decomposed sections of stringers cut out and remaining good timber insulated from the earth before back-filling. In such instances, it will always be found worthwhile to remove

the old timber, since such decay in the ends of stringers, if advanced, will result in failure through crushing. **(Photo No. 6).**

If only a few stringers are involved, replacement with new ones may prove economical. Of course, conditions allowing excess moisture to prevail at these points should be eliminated. More extensive decay may require replacement of all stringers and decking.

REPLACEMENT EXPENSIVE

Stringer replacement is an expensive and troublesome operation and attention to a few simple details will yield worthwhile returns in the form of reduced maintenance. Dirt and other debris is too often allowed to accumulate in and around the stringer and cap supports. It acts as a sponge to retain the moisture and is the direct result of a great deal of expensive repairs that otherwise would not be necessary. Maintenance forces too frequently neglect this condition, where an ounce of prevention in the form of a little elbow grease is certainly worth many pounds of cure.

When it is realized that a small amount of rot in the end of a stringer **(Photo No. 6)** will completely immobilize the entire stringer with its large remaining portions of sound wood, it is evident that the small amount of work necessary to avoid such conditions is well worthwhile. Summed up over a few hundred structures, the loss taken through reduced service life and added maintenance through failure to correct conditions of this nature becomes an astonishing item.

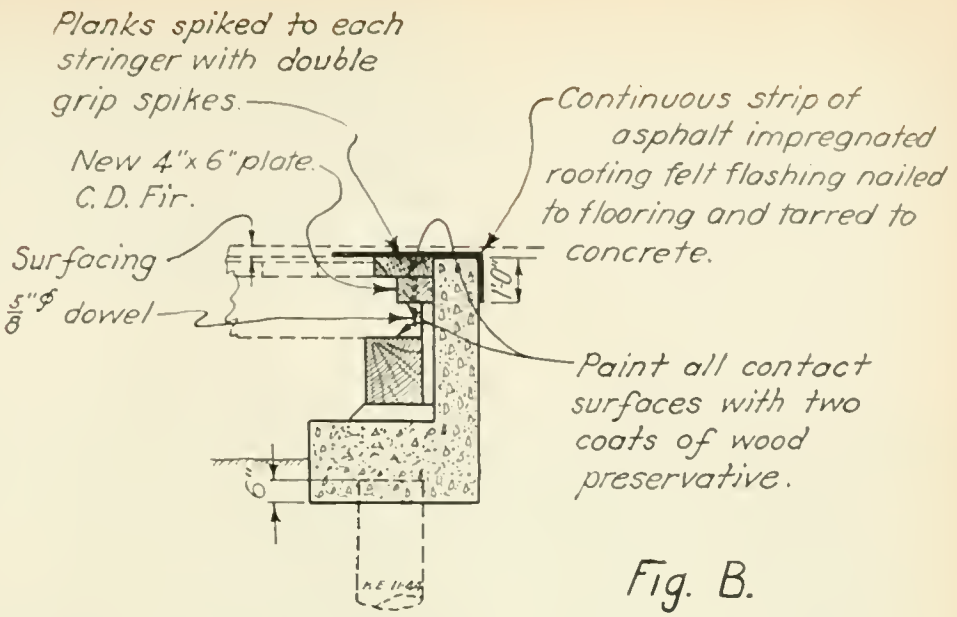


Fig. B.

STRINGER ENDS PROTECTED

Stringer ends should be well protected from moisture and construction should be such as to permit the free circulation of air in and around their ends. Corrugated sheet metal backing is an effective and economical way of providing good detail at this point. **(Fig. D and Photo No. 7.)** When used, it should be bent over onto the flooring to protect these parts from outside moisture. That portion of the corrugated sheet which is bent over onto the floorings should be flattened out so that no springing action will develop under wheel loads. Such springing can only result in breakup of surfacing with all the consequent damage resulting from such action. Clearance between stringer ends and the back-wall should be provided as shown in several of the figures.

Decay between stringers and top of cap also shows up in the crushing of the stringers and when serious, may require the complete replacing of damaged members or construction of a supplemental bent in front of the bulkhead.

MOISTURE DAMAGING

Ends of timber sticks, such as stringers and caps, are especially susceptive to decay. Moisture must be kept away from these parts and the ends of such sticks should be well treated with wood preservative.

Decay between cap and pile tops is evidenced through crushing of the caps **(Photo No. 8)**. Replacement of cap as well as stubbing of pile tops may be necessary.

When decay is extensive and replacement of the entire bulkhead is neces-

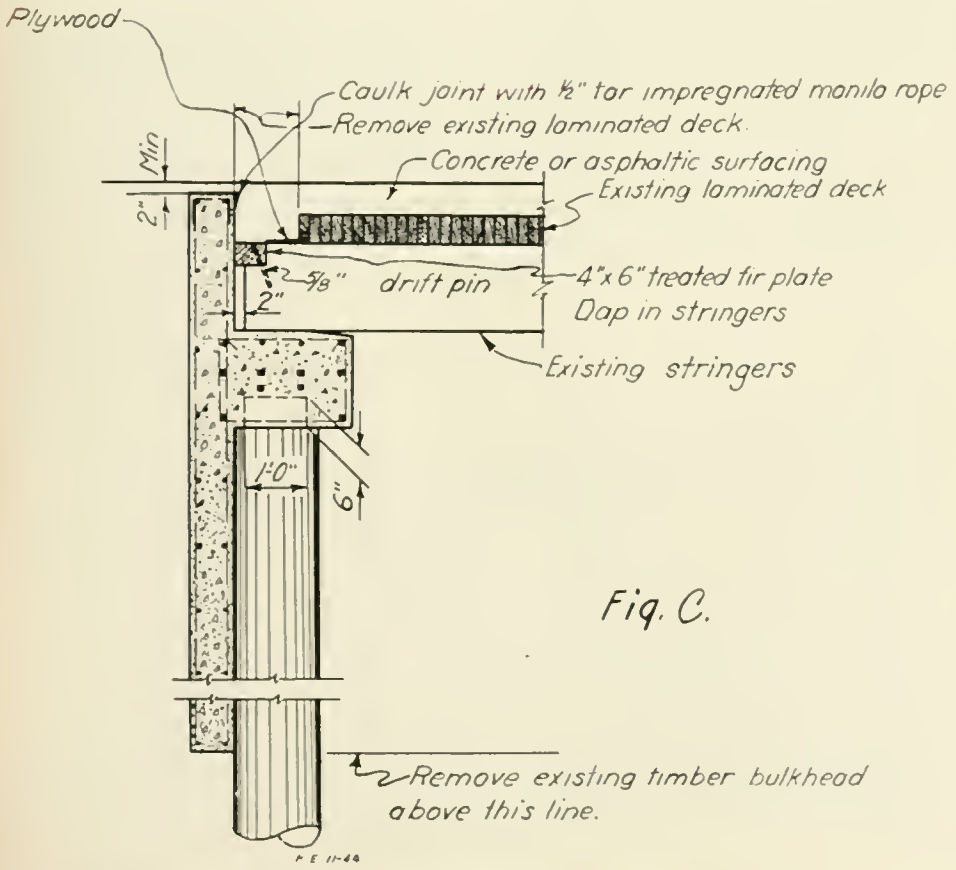


Fig. C.

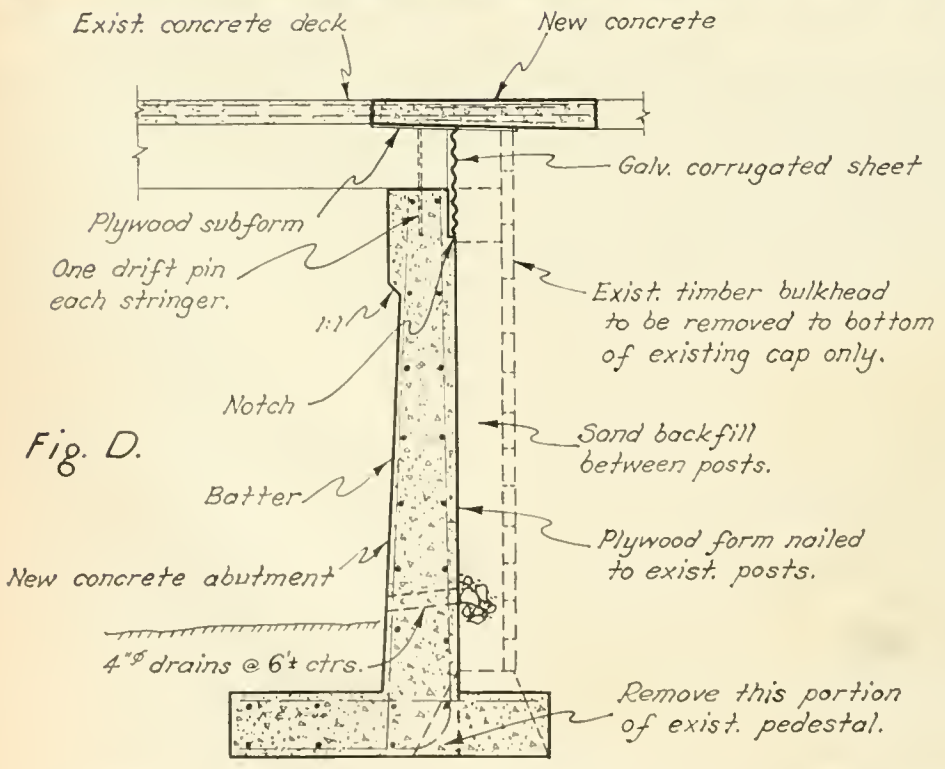
sary, several types of new abutments may be considered. Impending improvements might indicate re-alignment in the near future and temporary reconstruction at the present site may be necessary. Partial repairs by one of the several methods noted above can be made or replacement with untreated timber of like construction might be the most economical procedure. If alignment is final and a more permanent type of construction is indicated, a new concrete abutment may be constructed. One of several more permanent types of construction may be used as shown in **Figs. B, C, D.**

"L" TYPE CONSTRUCTION

Fig. B shows an effective "L" type of construction used in many structures. It may be built directly on old pile stubs if the condition of these is sufficiently good to give the required support **(Photo No. 9).** This is often the case and is an economical way of saving concrete in the new footing.

In the figure, note the small pedestal support for the cap which reduces concrete and timber contact surfaces and allows room for the accumulation and easy removal of small amounts of debris that are bound to collect around such locations. The space between ends of stringers and back-wall allows air circulation and the continuous asphaltic membrane gives the necessary protection against moisture infiltration, thus protecting the many timber contact surfaces at this location.





CROSS-OVERS

Several abutments of the type shown in **Fig. B** have been installed under traffic using the "cross-overs" shown in **Photos 10 and 11.** These have been made of salvaged 6-inch planks, built into units of three planks each for ease in handling. They will span an opening of approximately 6 feet and this generally allows sufficient room for working below grade levels. Such "cross-overs" are easily and quickly installed and can be transported and stored with a minimum of trouble.

Fig. C shows a type used extensively with treated timber piling. Treated timber piling and untreated timber stringers and flooring were in good shape with many remaining years of service life. Bulkhead planks and caps were badly deteriorated and effective backing with permanent construction was desired. Note clearance at stringer ends and caulking at joint to prevent admission of water. These are important considerations as indicated by the decay that develops at such spots, when such provisions are lacking.

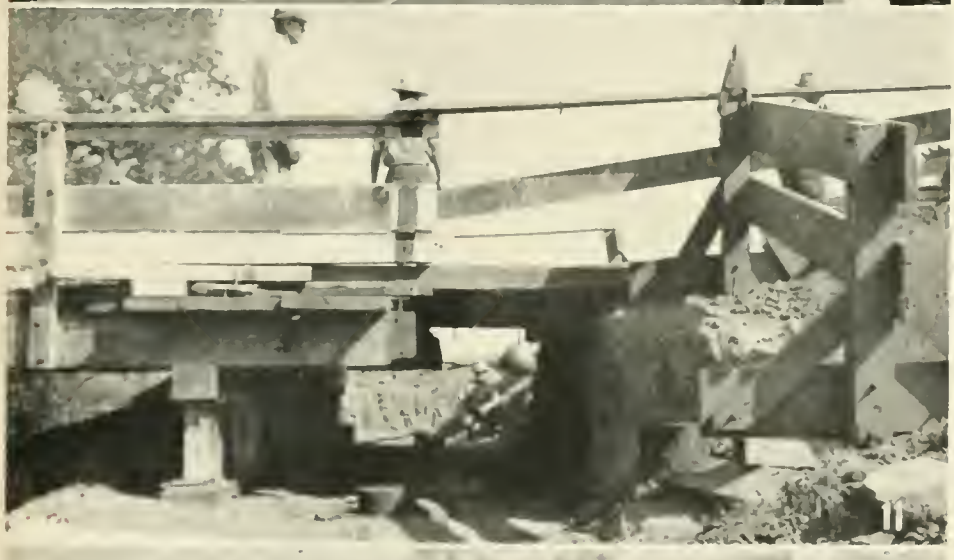
BULKHEAD REPLACEMENT

Fig. D shows a type of construction used to make complete replacement of a bulkhead. The work can be done under traffic and construction completed up to the bottom of the stringers before any portion of the traveled way is disturbed. Previous explorations with a timber boring outfit had definitely located the extent of the decay, thus establishing the exact position wanted for the new concrete wall and the length of stringers which had to be cut off.

Interference by existing concrete pedestals or timber posts is overcome without much trouble. After pouring footings, forms can be placed against the outer faces of the posts and the space back-filled with sand. Wings can also be completed at this time. Excavation on traveled way is made for one-half width of roadway, taking out a small section of the pavement and


9.


10.


11


12

approach roadway slab as well as the fill.

Removal of this fill is made deep enough to permit extraction of the old cap, the balance of the planks and posts being left in place. Corrugated sheet metal backing, as shown, is placed to protect the ends of stringers and to give proper circulation of air. Roadway and approach slab is then replaced.

SATISFACTORY TYPE

Photo No. 12 shows a counterforted type of abutment built directly in front of the existing old bulkhead, somewhat along the lines of the construction detailed in the paragraph immediately above. It is a satisfactory type under the proper conditions.

Photo No. 13 shows a type of construction made possible by using existing "dead-man" rods. The outer ends of these rods were tied to the old 6 x 6 inch wales and the extension necessary to grip the wales came in very handy, since the "dead-man" rods could be utilized as tie-backs for the new concrete wall.

The joint between the bridge end and approach fill is a weak and vulnerable point in timber deck and bulkhead construction. The need for impervious construction at this location and necessity of resisting the high impact forces occurring here, requires good, sturdy detail if the desired results in the form of water-tightness and rigidity are to be obtained. Some substitute for an end diaphragm must be provided for the flooring between stringers. Two of the figures show a plate about 4 x 6 inches. This plate dapped into the stringer ends and designed to give support to the flooring at this point should be well tied down to the stringers, either by dowels or long diagonal bolts through the plates and stringers.

The few types of construction above listed give some idea of the variations that may be considered in work of this nature. Of course, to enumerate all of the methods that have been used for the peculiar conditions that are continually presenting themselves in the maintenance of such structures is not possible in such limited space as is here available.

From this discussion, it is evident that most of the trouble arising in timber bulkhead construction is caused by decay due to excess moisture. Since this develops mostly at the contact surfaces between timber and those between timber and ground, protection of such surfaces against the inroads of



moisture is very important and may be provided in a fair degree by the employment of some of the methods noted above.

Equally important is the matter of keeping debris away from a few vital points in the structure. The matter of cleaning this debris away from such locations is badly neglected and does not receive nearly the attention it deserves. Incorporation of the measures above noted in the design, construction, repair and maintenance of such structures will be well repaid in reduced maintenance costs and increased service life.

George Bartlett Award Bestowed Upon C. H. Purcell

(Continued from page 7)

vised the expenditure of over 600 million dollars. Mr. Purcell, in January of last year, became Director of the California Department of Public Works.

"In 1941 the President of the United States appointed him a member of the Inter-Regional Highway Committee of seven. This committee's report is now a well known document.

"In his long and useful career this man has been untiring in exploring opportunities to fill out the entire area of his job to the fullest. He has improved highway technique and he has developed and inspired leaders.

"Mr. President, I take pleasure in introducing to you a member of your executive committee and a former president of your Association, Mr. Charles H. Purcell."

CALIFORNIA MISSIONS

(Continued from page 13)

can missions when he was overthrown by Pio Pico and his followers, including Echeandia, and on August 9, 1834, Jose Figueroa, who had become governor, issued his decree confiscating all California missions. In October of that year, Lieutenant Antonio de Valle was directed by the governor to take charge of San Fernando Rey as a paid administrator. His inventory valued the mission and its holdings at $41,714.

Ill from grief and heartbroken, Father Ibarra, probably out of his mind as a result of his sorrows, fled from San Fernando to Sonora, Mexico, in June, 1835, unable to remain and see the complete destruction of all his years of toil. With him went Father Estenaga of Mission San Gabriel, who had undergone similar treatment at the hands of the politicos. Their desertion was akin to apostasy from their Order, but Fr. Narciso Duran, the Commissary Prefect, understood their motives and forgave them. Father Ibarra returned to San Fernando in October, 1836, and Fr. Estenaga went back to San Gabriel. Father Ibarra died, broken in spirit, at San Diego.

San Fernando struggled along under various political regimes until December 5, 1845, when Governor Pico "leased" the mission and lands to his brother, Andres Pico, and to Juan Manso at a yearly rental of $1,120. The following year he sold the mission to Eulogio Celis for $14,000.

MISSION RETURNED BY LINCOLN

As was the case with the other missions, American occupation put an end to Pico and his ilk and on May 31, 1862, President Abraham Lincoln returned San Fernando Rey to the Catholic church.

Restoration of this old mission, which was begun in 1897, by the Landmark Club has made of it one of California's beauty spots. Here is beautiful Brand Park, the land for which was presented to the city of Los Angeles by the Mission Land Company in 1920. The original star-shaped fountain built more than a century ago by the Indians under direction of the padres was given in 1922 to the park by L. C. Brand, who had it removed from the old mission fields. Here also is "Memory Garden" in which are olive trees dedicated to the famous men who took part in the conquest of California and pepper trees raised from seed gathered from the aged trees planted at Mission San Luis Rey. The Oblate Fathers took charge of San Fernando Rey in August, 1923, erected a church for Mexicans in 1925 and established there a school.

Mission visitors motoring from south to north over the "Trail of the Padres" pass through the City of Los Angeles. From Seventh and Broadway, in the heart of downtown Los Angeles, the route is out Broadway to San Fernando Road, State Highway Route 4, U. S. 99, known as the Inland Route to San Francisco, to the City of San Fernando, a distance of 17 miles. From the main highway, Mission Bell signs direct the visitor to San Fernando Rey de Espana, about one mile from the center of the business section of the city.

Visitors from the north may motor through the San Joaquin Valley over State Route 4 which leads direct to San Fernando. Or, coming south over El Camino Real, State Route 2, U. S. 101, known as the Coast Highway, the motorist will turn east at Montalvo, just south of Ventura, and travel State Route 118 through Saticoy and Moor Park direct to San Fernando.

Next—Mission San Buenaventura and Mission Santa Barbara.

What Expense is Justified for Aesthetic Treatment of Parkways?

By H. DANA BOWERS, Landscape Engineer

The following paper was delivered to the Roadside Development Committee of the American Association of State Highway Officials at the annual meeting of the Association in Cincinnati on November 27, 1944.

WITH a large program of projects in the postwar period for landscaping and roadside improvement on Freeways and Parkways comes the thought to us Landscape Engineers that Roadside Development has finally come into its own.

At last it appears we will have the pleasure of planning for a comparative permanent roadside development project and perhaps live long enough to enjoy its ultimate development without suffering the repeated sad experience of seeing the destruction of our favorite brain-child to make way for more lanes to accommodate more and faster traffic.

However, as with all pleasant dreams, we eventually wake up to the cold reality of the dawn to find the facts of life once more confronting us. Again it is a matter of economics.

Some time ago I wrote to the Chairman of the Roadside Development Committee of the American Association of State Highway Officials in connection with determining the justification for large landscape expenditures on Freeways and Parkways. The letter is quoted:

WHAT SHOULD COST BE?

"Dear Mr. Wright: Reference is made to my informal discussion with you at Chicago relative to the possibility of promoting a research project by your committee on Roadside Development for the purpose of determining the justifiable economic limits of Roadside Development for various highway classes.

"Postwar plans contemplate the construction of several types of roadways. Among them are Freeways or Parkways which, in my opinion, merit immediate concern. Experience in landscaping of Freeways has revealed the high cost involved in the installation and maintenance of roadsides treated commensurate with the location. Since the proposed mileage of similar conditions is considerable and, in view of the $3,000 per mile per year it costs for roadside or landscape maintenance alone, on one of our Freeways, I am greatly concerned as to the repercussive potentialities of continuing such high type treatment.

"In determining the practical limits to which we can go it might be in order to first line out the various highway classifications as regards to landscape requirements. As an example, a Freeway connecting two urban areas could comprise three classifications: urban, suburban and rural. Each could have separate landscape requirements.

DEFINITE ECONOMIC VALUE

"We know that soil stabilization or erosion control has a definite economic value and expenditures for this purpose can easily be justified. The justification for expenditures to create and maintain aesthetic values, however, is a debatable question and one that can readily become a subject of dispute. With the advent of postwar Freeway construction with its wide right-of-way and large areas at separations there will naturally follow demands from civil organizations for embellishment. These demands, often impractical, would be much simpler to resist or reason with if the States as a whole could adopt some kind of an agreed standard or policy. Whether such a policy could be made to fit both eastern and western conditions is a subject for study. I trust I have made myself clear and would appreciate your reaction to proposing such a project to your committee."

It would seem that one approach to the problem would be to define landscape requirements. We can not say that these requirements are merely matters of opinion. In order to justify a continuous program and to prevent criticism outside the organization as well as from within we should be able to show a profit, as it were, on the investment.

TWO LANDSCAPE REQUIREMENTS

Aside from the fact that things should look well, even roadsides; assuming we have all the Garden Clubs, advocates of beauty, and "down with the billboards" groups to champion our cause, the public in general and engineers in particular do not always appreciate seeing money expended merely to improve appearances. When such expenditures are questioned, it would be well to be able to show the potential dollars and cents saved as a result of our labors. It is up to us, therefore, to produce.

Now in general there are only two landscape requirements; first, soil stabilization which without question can be justified economically; and second, the aesthetic requirement which is so often the bone of contention.

The strongest argument in favor of aesthetic treatment is the effect which the bisecting of a community or a high type of residential or business district by highway construction can have on the value of the property in that neighborhood.

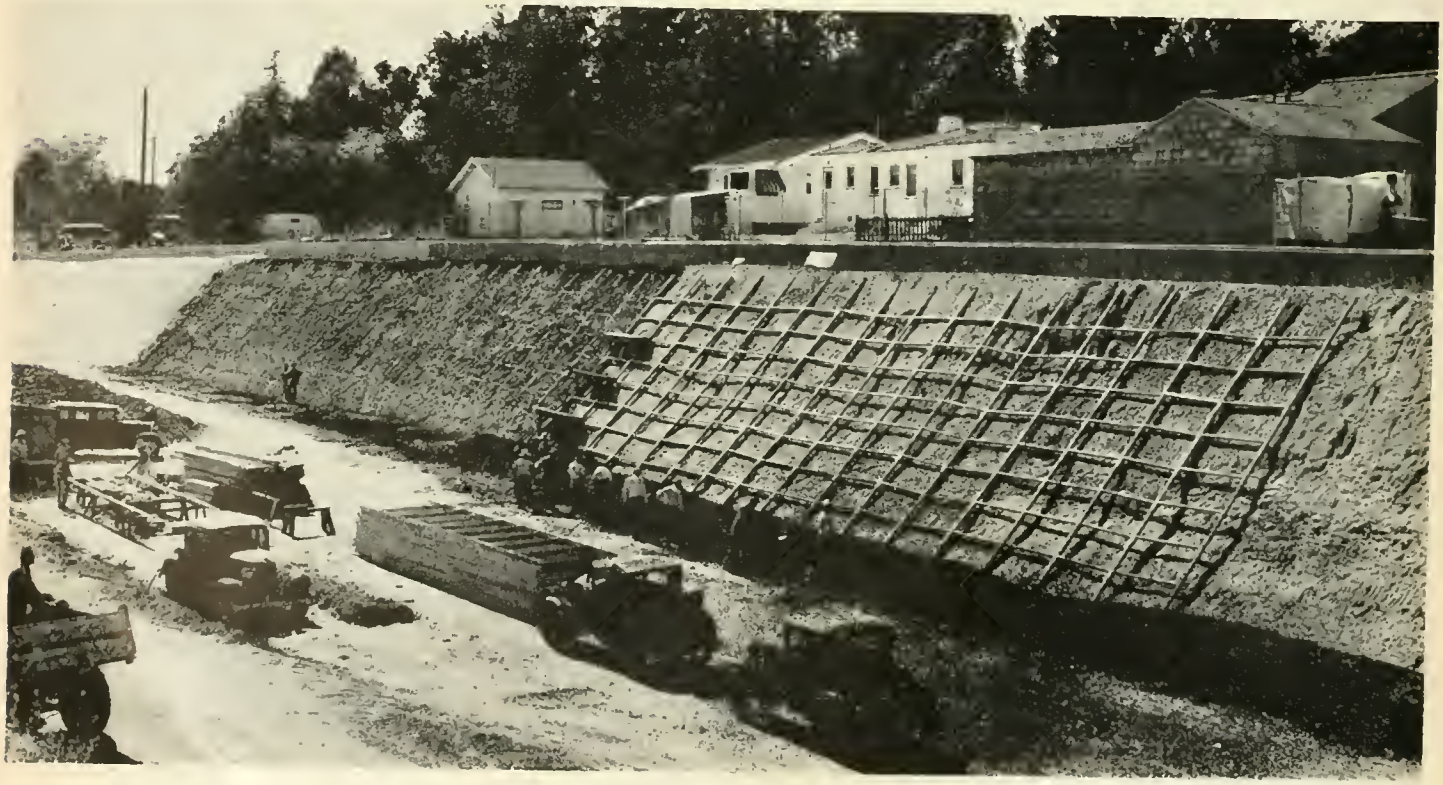
FUTURE LAND VALUES

The future value of these affected properties bear a direct relation to the general appearance of the highway. If treated to simulate a park-like appearance and neatly maintained, it reasonably follows that the proximity of such a landscaped arterial will uphold existing values and in many cases augment them. Income and taxation from these properties will then suffer no loss. On the other hand, if we become superpractical and confine our treatment to soil stabilization alone, without regard to appearance, which could easily be done, the result could still be an eyesore and a detriment to the developed adjoining property.

To more clearly emphasize the economic value of proper landscaping, let us assume the alignment of the highway is diagonally through a residential section of modest homes of the $4000 to $5000 class, where real pride



1—Looking easterly toward the Orange Grove Avenue overpass in South Pasadena. This is one of the bridges over the Arroyo Seco Parkway between Los Angeles and Pasadena opened to traffic in July, 1940. To save right of way cost, slopes were constructed on 1:1. Soil encountered was sandy gravel and clay loam.



2—Slopes in process of stabilization. In order to establish growth to prevent erosion on these steep slopes, wooden frames were laid on the slope to form boxes 3 feet by 2 feet by 4 inches. These were backfilled with a mixture of top soil and manure. Straw was then applied approximately 6 inches thick and held in place by 4 inch mesh galvanized reinforcing wire tied firmly to the wooden frames and to the top and base of slope. Vines were planted through the wire and straw at 18-inch intervals. Irrigation is provided by a type of irrigation system laid along the top of slopes.



3—The same area as it appears today. Growth has been successful in preventing loss by erosion as well as providing a colorful and pleasing slope cover. Varieties of plants used include lantana, honeysuckle, English ivy, periwinkle, ivy geraniums, moon vine and mourning rose. All bridge piers and abutments are planted with Boston ivy to effect a tracery of green over the concrete surface.

of ownership exists. Assume also, that the highway is constructed on a fill through this area.

Without landscape treatment, it is probable that the value of abutting properties will be depreciated from 15 per cent to as high as 50 per cent. Payment of damages to compensate for the depreciation in value would not rehabilitate the property values. This could only be accomplished by appropriate treatment to restore aesthetic values.

TAX ROLL AFFECTED

Assessed value of these depreciated properties proportionately reduces the tax roll, with the result that the income to the public treasury is reduced. I can conceive of many cases where this reduction in public income can, in a reasonable period of time, amount to more than the total cost of appropriate treatment of the highway.

It naturally follows that if the highway passes through a section where residences are in the $20,000 to $50,000 class, the justification for landscaping for this one purpose alone, is multiplied several times over.

From this standpoint alone then, we can reasonably evaluate aesthetic treatment in dollars and cents.

Other arguments in favor of aesthetic treatment are the abatement of traffic noises and the restoration of privacy of the home through vegetative screening. Sound and sight can be effectively reduced and screened off with plants.

DISADVANTAGES

These two particular disadvantages frequently represent real nuisances to adjoining property. The fact that we may construct a high fill directly beside his dwelling, but on adjoining land, represents no different condition than to construct a building of several stories with a blank wall in the same location. Unless his property suffers material damage no compensation is legally due him, if the construction does not encroach upon his land; affect an existing street in front of his property, or his access rights.

So far we have discussed the situation as it affects property of the better class residential and business districts. How about the reverse, where the route lies through blighted areas or slum sections? We can hardly maintain the argument of decreased property values in this case. In all probability, however, an improved highway will enhance these values and serve to rehabilitate the area. And, in my opinion, landscaping of the highway will be directly reflected in appreciation of land values. Temporarily it will eliminate unsightly views from the highway. It is more difficult to fix a monetary value to this type of service. The type and cost of treatment given would seem to depend more on an adoption of policy to contribute to improve civic conditions or pride in engineering achievement of a pleasing road well designed and constructed.

DIFFERENCE IN COST

There is a considerable difference in the cost of treating some 6 acres per mile on 100 feet of right of way

as against some 20 acres per mile on urban parkways. The purchase of right of way through cities can not always be confined to the minimum width required for the roadway. Entire lots along with improvements thereon must be acquired and more often than not that portion of such parcels not needed for the highway, have little or no value for residential or commercial use. The problem of their treatment and maintenance then follows.

In California we can always depend on two things, dry summers and dry weeds and grasses. These present a serious fire hazard that obviously must be controlled in some manner. They also present an unsightly appearance particularly through urban and suburban areas where the contrast is not a pleasing one. That brings us back to the question: How much of an expenditure can be economically justified for the aesthetic treatment and maintenance of Parkways?

This question may not register as particularly important with some of you Easterners, so fortunate as to be blessed with natural overhead irrigation, but in the Western States it is a number one problem.

ARROYO-SECO PARKWAY

For example, our Arroyo-Seco Parkway between Los Angeles and Pasadena, 7 miles in length, costs $22,000 per year or an excess of $3,000 per mile per year for maintenance. This entire area is planted to various ground covers, trees and shrubs, and is all under sprinkling system. We have no ground cover sufficiently drought resistant for inland use, to maintain a green cover throughout the summer season and compete with the natural weeds and grasses. The use of native indigenous material can be made to provide suitable screen plantings without irrigation, but the problem of fire hazard beneath and between these plantings still remain. We can not seem to adopt half way measures in our planting and still produce an attractive effect, appropriate through urban or suburban areas.

It can be said that a Parkway costing on an average of one million dollars per mile for right of way, and one and one-half million per mile for construction, and traversing residential and business districts, should be treated and maintained commensurate with the adjoining community and its benefit and enjoyment to the traveling public.



Prospect Avenue overhead, Arroyo Seco Parkway, before and after landscaping

POSTWAR PROJECTS

Such treatment now prepared for postwar projects will be expensive. Planting preparation constitutes the big percentage of the cost since in many cases, all top soil must be imported, and it takes considerable top soil to cover 20 acres per mile, even with a skimpy 6 inches. Growing conditions are not good, by any stretch of the imagination, where buildings and drives have existed for several decades. If planting is to be done, it is more economical in the long run to give every consideration to the preparation of the soil. However, curtailment on installation, invariably results in prolonged excessive maintenance. To continually seek more maintenance money to rectify the mistakes of cheap installation, is an irritant to any organization. It is an excellent manner in which to retard the progress of Roadside Development, since to the many highway engineers, landscaping is still to be tolerated rather than encouraged.

Any way we look at it, landscaped or not, the additional right of way needed for Freeway and Parkway construction is going to boost maintenance costs materially. It would seem that a few comparative figures of maintenance cost on variously treated roadsides might aid in arriving at some answer to the question. We know in California that the difference will be considerable, if we expect anything at all attractive. With the exception of irrigation from about October to March, our maintenance varies little throughout the year, and neglect is immediately noticeable.

Former Highway Men Hold Reunion in Far Pacific

FOURTH USN CONSTRUCTION BRIGADE

c/o Fleet Post Office
San Francisco, California

JWD;aa
8 September 1944

To: All Officers in Charge

PLEASE POST

1. All former employees of the State of California, Division of Highways are invited to attend a roundup at the 4th USNC Brigade office at Lorengau on Sunday 17 September 1944 at 1400.

2. Come and get in the pictures and join in a "I knew you when" bull session.

3. Men, Chiefs and Officers come and see the pals you didn't know were here.

Lt. J. W. Davis, CEC, USNR
Former member, Bridge Dept.
State of California
Division of Highways.

All Const. Regiments
All Const. Battalions
All CBMU
PAD ±1
Drydock
ABCD Annex



In this setting in the South Pacific, Division of Highways men on military leave staged a reunion. The Roman numerals following the names of some of the celebrants indicate the California Highway district in which they served before the war. Standing, left to right, Lt. (j.g.) W. C. Ewing, II & IV, 4th Brigade; Lt. E. R. Foley, Bridge Department, 46th C.B.; Lt. J. W. Shaver, I-II-VII-VIII, 4th Brigade; Lt. R. J. Ivy, Bridge Department, 44th C.B.; CMM P. A. Goforth, VII & XI, 78th C.B.; Lt. J. W. Davis, I-IV & Bridge Department, 4th Brigade; CMM T. J. Hagerman, Maintenance Shop 2, 78th C.B.; CWO K. E. Pilkenton, XI-VIII-VI-III-I-X-V, 78th C.B.; EM1 c A. Fross, Bay Bridge, 44th C.B.; Kneeling, left to right, MM1 c R. H. Barrett, California Highway Patrol, Bakersfield, 78th C.B.; CCM W. R. Borden, II, 5th Regiment

THE foregoing bulletin posted in Army and Navy camps in the South Pacific last September resulted in 11 former employees of the California Division of Highways getting together for a reunion.

With a letter to F. W. Panhorst, Bridge Engineer of the Division, Lieutenant J. W. Davis, formerly on Panhorst's staff, who sponsored the party, sent the accompanying photograph. Davis wrote:

"I'm enclosing a photograph taken in the Admiralty Islands of a group of 11 out of 14 former members of the Division of Highways. There were four of us from the Bridge Department all working on the same base.

"Mike Foley worked in the materials section as X.O. of ABCD. Ray Ivy was on bridge and dock construction. Bill Hedgepeth worked with me as electrical engineer and I ran the design and field engineering department for the Brigade. It certainly seemed quite a coincidence that everyone should meet up here halfway around the world.

"During the time I've been in both the Hebrides and Admiralties the past two years I've met many former State highway employees and it has been most interesting swapping stories.

"At the present time, I'm with NATS in the construction department, which has taken me on quite an extensive tour of the South and Southwest Pacific area.

"Merry Christmas and Happy New Year."

"Jack Davis"

Commissioners Reappointed

Governor Earl Warren has reappointed for four-year terms State Highway Commissioners James Guthrie, San Bernardino publisher, and Chester H. Warlow, Fresno banker, whose terms expired January 15th.

Under a legislative act reorganizing the Highway Commission, Governor Warren on September 14, 1943, named a new Commission with Director of Public Works C. H. Purcell as chairman. The appointees drew straws to determine their staggered tenures of office. Walter Sandelin, Ukiah, who drew the short term, was reappointed by the Governor last year for four years and now Mr. Guthrie and Mr. Warlow have been sworn in again. Commissioner Harrison R. Baker, Pasadena, holds office until January 15, 1946, and Commissioners Homer P. Brown, Placerville, and C. Arnholt Smith, San Diego, until January 15, 1947.

Origin of Sections, Townships and Ranges Goes Back to Colonial Days

IN 1784, the Virginia cession finally was completed, and a committee was appointed to prepare a plan for the disposal of the lands. The idea was to use the public lands as a fund to pay the public debt. The committee of 1784 was composed of Thomas Jefferson of Virginia, chairman; Hugh Williamson of North Carolina, David Howell of Rhode Island, Elbridge Gerry of Massachusetts (of "gerrymandering" fame), and Jacob Reed of South Carolina. This committee did not attempt to formulate a new plan for the disposal of the lands but turned rather to the methods already in use by the colonies, which methods were two in number, and have already been described.

On May 7, 1784, Jefferson's committee reported to Congress, and although three of the five members came from the Southern States, they recommended the New England System of "discriminate" prior surveys. The features of this report were that surveys should precede sales; tracts of ten geographical miles square, subdivided into one hundred lots, were to be laid off and called "hundreds"; there was no provision for education or religion. The Southern System of disposition, by warrants, certificates and caveats, was to be used.

This report was in Jefferson's handwriting, and he was, no doubt, its principal author; the provision for ten mile townships was in line with his recent advocacy of hundred mile States, and decimal money divisions; although we will see that later this idea was in his absence, waived in favor of the Northern half dozen or six mile ideas. On May 28th, Congress voted not to consider the report at that time; only North Carolina voting for immediate action.

WASHINGTON VISITS WEST

But settlers kept passing over the mountains into the Ohio territory; the soldiers were demanding their promised bounty, and the need of increased revenue was felt. Accordingly, in the summer of 1784, Washington visited the west, and although he did not reach Ohio, was convinced of the necessity of a compact settlement of the New Country, and he stated this fact in letters to Jacob Reed, then a member of Congress. Washington told of the roving of the people, and of the marking out, surveying and settling of lands, and the consequent discontent among the Indians.

Washington also wrote to Richard Henry Lee, then President of Congress, on March 15, 1785, advocating the sale of a small amount of land at a medium price; and favored the idea of "progressive seating," as he called it. This "seating" could be best obtained under the township plan of the New Englanders, although it does not follow that Washington had that plan in mind. These letters of Washington must have had some influence on the action of Congress in this matter; how much, we do not know.

THE SECOND COMMITTEE

On March 5, 1785, the report of 1784 was again considered by Congress. It was read a second time, and after a debate, was referred to a committee of one member from each State, the most prominent of these being William Grayson and James Monroe of Virginia, and Rufus King of Massachusetts. (Jefferson had been sent to France to aid Franklin and Adams in making treaties with European countries.)

This committee reported on April 14th. They kept the rectangular townships, but reduced the size to seven miles square; and substituted statute miles for geographical miles; they insisted on "township planting," sales to be at public auction for not less than one dollar per acre. There were reserves set apart for schools and religious uses, and for the future disposition of Congress.

The day after the report was presented to Congress, Grayson sent a copy to Washington, and gave the reasons advanced by the advocates of the measure, which were as follows: Surveys were urged, because they would avoid boundary disputes, and surveying into squares was least expensive. Sale by auction was defended, because it gave the same chance to those away from the lands. Sale by townships, with the aid for education and religion, was urged, because it encouraged purchasing and settling together, which end would be defeated by the Southern method of "indiscriminate location."

Under the proposed system, the poorer classes would unite to buy a township, while the speculator would be excluded, because the price would be too large; and if he did buy, the cry

INTRODUCTION

WE know that there exists in some of the States of the Union, a system of land description unlike that found in the other States, or in any other part of the world. We know that this system is of recent development, and that in the history of modern, mediaeval, and ancient nations, no similar system ever existed. Since the days of the clay tablet deeds of Babylon, land had always been described by boundaries, and ownerships were irregularly placed. Lands were always settled first and surveyed afterwards. Somebody hit upon the idea that this process should be reversed; that land should be regularly surveyed before settlement, and the settlers be compelled to conform to such survey; and that land descriptions would be greatly simplified, and controversies minimized, by laying out the public domain into a gigantic gridiron of sections, townships and ranges.

Who invented this system? Why was it invented? And where did the inventors get the idea? Why are sections six miles square and why the back and forth numbering? It is believed that the story of this, the first improvement in land plotting since the dawn of history, will prove interesting to Highway Engineers and Right of Way Agents, whose daily work is the handling of these tracts of land.

The accompanying article by Frank J. Cordes is the second of two installments.

for greater revenue by the government would be answered. Transfer by deed was required, and the formalities of warranties, entries and returns, were abolished. From Grayson's letter, it is very clear that the members from the Northeast had their own way in every important particular.

DISCUSSION IN CONGRESS

Grayson asked for Washington's opinion on the proposed plan, and Washington, on April 25th, forwarded a criticism. He favored the township plan, but objected to the proposed sale of lands by the respective States. He believed that this would lead to state jobbing; and that Federal ownership and a central land office would be more convenient and encourage more competition in buying. Incidentally, this was one of the first features of the Ordinance to be amended.

When the report was presented, the discussion was carried into Congress. It was apparent that Congress was willing to accept the advantages of the rectangular surveys before sale, but the delegates from the South opposed the "township planting" feature; and they sought to amend the clause that provided that land could only be sold by entire townships, and advocated that settlers should be allowed to purchase smaller amounts whenever they desired. The conflict then, was between the theory of the Northeast compact settlement and discriminate locations, and a modified Southern System of rectangular surveys, but with individual purchases by smaller sections.

THE LAND ORDINANCE

The Land Ordinance was under consideration for over a month in New York City where Congress was meeting. It so happened that on April 18, 1785, the New York legislature passed a land law providing for townships of six miles square; and should a body of persons unite to purchase a township, they were to receive lands for schools; but smaller tracts up to 500 acres might be sold. It became apparent in Congress that neither party could have its own way as to the size of the minimum tract to be sold. A proposed compromise provided that half of the townships should be sold as a whole; and the other half should be sold to a New York purchaser selecting 640 acres, without the surrounding land being sold; but his tract had to be bounded by sectional lines. Another amendment reduced the size of the township to six miles square (an obvious compromise by the Southerners in favor of New England). Still another struck out the provision of a section in each township for religion as tending to create a State church.

Finally, on May 20, 1785, the Land Ordinance was passed. It provided as follows: Territory ceded by the States was to be sold as soon as the Indian titles were purchased. The formation of states was no longer a prerequisite. Land was to be surveyed in townships six miles square, subdivided into lots or sections one mile square. First lines North and South, East and West, were to commence on the Ohio River at the Pennsylvania border; and only the township lines were to be actually surveyed. Townships were to be sold alternately as a whole and by lots. Sales were to take place in the states. A range was a tier of townships, running from North to South, enumerated from East to West. When seven ranges were surveyed, the townships were to be drawn by lot, one-seventh for the Continental Army, and the balance for the states, to be sold by the commissioners of the land office therein at public auction. A minimum price of one dollar per acre was established to be paid in specie, or land office certificates; but the expenses of surveying, calculated at thirty-six dollars a township, were to be paid by the purchaser at the time of sale. Purchasers secured deeds for definite tracts of land. Congress reserved sections 8, 11, 26 and 29, in each township, and one-third of all gold, silver, lead and copper mines. Section 16 was reserved to maintain the public schools. The form of deeds and the manner of issuing them was also provided for.

Thus, this Ordinance of 1785, which is the foundation of our national land system of Sections, Townships and Ranges, was a compromise of conflicting interests and opinions, based on the methods used by the older states. The presurvey features of the Northern township system were adopted, along with the individual or section purchase ideas of the South.

APPLICATION OF THE SYSTEM

The first application of the new Congressional Township plan of 1785, was along "Ellicott's Line" or the Eastern edge of the Northwest or Indian Territory, now the State of Ohio. These are the "Old Seven Ranges." The starting point of the first principal meridian, governing succeeding ranges, is the junction of the Ohio and Miami Rivers. As the country grew, other principal meridians were established, and designated by numbers, up to the Sixth, in Kansas and Nebraska. The Third begins at the confluence of the Ohio and Mississippi Rivers, and the Fifth at the Mississippi and Arkansas Rivers. After the Sixth, the meridians were designated by name. Some were named for rivers, as the Willamette, and the Gila and Salt River meridians. Others took the names of mountains, as Mount San Bernardino, and Mount Diablo. The area governed by each meridian differs greatly. The Fifth runs to Township 163 North and Range 106 West.

The Ordinance of 1786 provided for a Surveyor General. Rufus Putnam was the first to hold the office. Jared Mansfield was the second. Under the Act of 1812 Edward Tiffin became first Commissioner of the General Land Office. He introduced our present system of offsetting for the convergency of North and South lines due to the curvature of the earth.

SIZE OF TOWNSHIPS

The size the townships were to be was at first doubtful. The original suggestion was as we have seen, ten miles square, later changed to seven miles. The New York State Military lands were laid out in townships ten miles square, and the Ohio Military and Connecticut Reserves, five miles. Col. George Morgan planned townships five miles square for his colonization scheme in Spanish Missouri. It is rather obvious that a ten mile township would have been more convenient for future descriptions, than the six mile township which was actually adopted.

Under the Act of 1785 the townships were not officially sectionized. Under that of 1796 half were sectionized. Under those of 1805 and later dates all of the townships were divided.

The starting point for numbering the sections was in doubt at first. In the Old Seven Ranges, Section 1 is at the Southeast corner, and the numbering runs Northwardly and begins again with Section 7 at the South. This arrangement was advocated by Thomas Hutchins, United States Geographer. But Congress later decreed that we should start at the Northeast corner, and that the numbering should continue back and forth throughout the township (which is really not the best possible arrangement). This may have been because the first surveys began at the South line of the Connecticut Reserve, and were staked out by surveyors walking westwardly and returning

(Continued on next page)

Holding State Highways In Central California



This photograph shows type of new surfacing on U. S. 99E north of Durham in Butte County

IN keeping with the war effort, the 1944 highway work in District III of the California Highways has been confined to essential repair, heavy maintenance and small access road projects to military establishments.

The 11 counties of this district roughly cover the area between Galt and Chico and between Clear Lake and the Nevada State Line. Most of the heavy access roads and flight strip construction was completed in the first two years of the war.

A typical example of the work under way during the year 1944 is exemplified in a project just being completed in the vicinity of Nelson and Durham in Butte County on Highway 99E.

The original highway consisted of some of the first concrete road constructed in the State and has served remarkably well even though constructed on soil which present day practice would not tolerate as subgrade material.

This new protective work consisted of placing a two-inch blanket of plant-mixed surfacing over areas of the original concrete that was still in fair shape, while on the remaining section it was necessary to add a blanket of imported material and a course of crusher run base to raise the grade line for drainage purposes and to reinforce the shattered pavement. A double seal coat was applied to the crusher run base and will serve until a plant-mix surface can be added in the future.

Gravel from a local stream was utilized in producing all materials except screenings, the result being that a high quality product was obtained at a comparatively low cost, at the same time using a minimum of critical shipping facilities.

This typical work was performed by Contractor Piazza and Huntley, with Mr. E. L. Miller as Resident Engineer.

Origin of Sections, Townships and Ranges Goes Back to Early Colonial Days

(Continued from preceding page)

toward the East along the next tier of sections to the South.

CONCLUSION

In this way was laid the foundation for our great American system of land plotting, the only improvement in property description since the earliest records of ancient times. If the Congress of the Confederation had done nothing else, it would have distinguished itself by thus setting up our unique system of Sections, Townships and Ranges; a system so far superior to any other previously used, that its minor defects can be readily overlooked. And while we are heaping praises upon Jefferson, Washington, and the rest of the fathers of our country, for their other governmental achievements, let us remember that not the least of their successful experiments was the Rectangular System of Pre-Surveys of the Public Domain.

Wartime Road Construction in District I

(Continued from page 6)



Showing type of deck surface on and approach to new Albion River Bridge

To overcome this type of failure an open graded aggregate mixed with E grade asphalt of 100 to 30 penetration has been used for the first time in this district to surface about 13 miles of highway. The open graded mix, not having the percentage of fine particles found in the dense graded, should be relatively free from capillarity, and if this anticipated result is demonstrated by the subsequent performance of the pavement, it should prove of distinct value to this district in securing a pavement not susceptible to failures from moisture.

Three grading and surfacing contracts awarded since 1942 are in Class 3 and were considered essential to the war effort to prevent disruption of the hauling of high priority materials or to military and civilian traffic.

These projects, estimated to cost $91,342, provide four-tenths mile of approaches to the new Albion River Bridge on the Mendocino County coast, five-tenths mile of modern highway on the north bank of the Smith River in Del Norte County as incidental to replacing an unsafe timber bridge 89 feet long with a 60 inch concrete culvert, and finally a project using Federal Access funds for timber roads, involving the reconstruction of nine-tenths mile of highway on new alignment and grade, together with the widening and resurfacing of 1.4 miles all along the north bank of Mad River in Humboldt County. This road has to be used as a detour for heavily loaded lumber trucks to avoid a weak and obsolete bridge on U. S. Route 299.

DISTRICT I
HIGHWAY CONSTRUCTION 1942-1944

Location	Contractor	Type of Work	Length Miles	Cost	Date Completed
Arcata-Eureka Section Base	John Carlin Const. Co.	Bridges			
	Mercer, Fraser Co.	Grade-Surface	11.060	$351,669.75	10/ 8/43
I-Men-Lak-15-49-89	Harold Smith	Resurface	8.272	67,201.16	11/ 9/42
I-Hum-1-G	Mercer, Fraser Co.	Resurface	2.700	41,372.68	9/25/42
I-Men-1-B	E. A. Ford	Resurface	6.680	42,530.85	7/ 1/43
I-Men-1-G,H,I	Close Building Supply	Resurface	4.410	19,709.42	9/ 7/43
I-Men,Hum-1-K,A,D	Close Building Supply	Resurface	8.088	25,625.50	8/31/43
I-Hum-1-J	Mercer, Fraser Co.	Resurface	5.041	39,812.74	10/21/43
I-Hum-1-J	Marshall S. Hanrahan	Resurface	9.042	158,070.11	10/ 4/44
I-DN-71-A	Marshall S. Hanrahan	Resurface	9.230	52,435.94	8/12/44
I-Men-1-H	Close Building Supply	Resurface	1.964	36,865.33	6/15/44
I-Men,Hum-1-I,A	Clements & Co.	Resurface	9.700	107,251.90	
I-Hum-1-E,F	Mercer-Fraser Co.	Resurface	3.700	52,343.34	
I-Men-48-56-C,D	Ted Watkins	Resurface	3.360	36,111.21	7/ 7/44
I-Men-56-D	A. J. Clausen	Grade-Surface	0.400	28,819.84	7/21/44
I-Men-48-B,A,D	Elmer J. Warner and Ted Watkins	Resurface	4.400	30,682.65	10/13/44
I-Men-56-D,E	A. Teichert & Co.	Resurface	3.850	40,721.14	9/11/44
I-Hum-20-A	Mercer, Fraser Co.	Resurface	5.100	47,517.75	Under Construction
I-DN-81-A	John Burman & Son	Grade-Surface	0.50	31,787.44	Under Construction
I-Hum-85-A	E. B. Bishop	Grade-Surface	0.900	30,734.50	Under Construction

State Assumes Maintenance of Route 127 Within Death Valley

E. W. [illegible], Assistant Highway Engineer







In Memoriam

[illegible]

District VII Builds 22 Access Roads as Part of Its War Effort

(Continued from page 4)

neers and city councils as well as be subjected to the usual searching review by the Public Roads Administration.

Only three of the access roads were in any part on the State Highway System and of those three, only one had any considerable portion of its length on the State system.

On the whole the contractors have had very little delay through shortage of materials but the manpower shortage has been constantly in evidence. At times all of the output of the available asphalt plants has been taken over by the Army or Navy, causing delays in placing the surfacing.

NEW PROJECTS

Bids have just been opened on one more access road. Plans are nearly completed on a second. The Federal Government has set aside eight million dollars for yet another access road project, studies for which are in progress; but it is not likely that actual construction on this project will be started while the manpower shortage is as acute as it is at present in this area.

These access roads, together with postwar planning, have completely occupied the depleted district forces and it has been found difficult to meet the established deadlines on postwar projects with the engineering personnel available.

The following table gives a list of the projects, together with contract, cost and major item of work:

Location	Amount	Contractor	Access to	Type of Improvement
Los Angeles—Stewart St., Exposition Blvd. and Dorchester Ave.	$61,627.50	Griffith Company	Airplane plant	Plant-mix surfacing on imported base
Orange—Katello Ave. and Dennis bet. Los Alamitos Blvd. and Farquhar	$82,784.08	Griffith Company	Naval aviation training base	Plant-mix surfacing on imported base
Los Angeles—Redondo Blvd.	$101,786.37	Vido Kovacevich	Airplane plant	Widen and resurfacing existing road with plant mix
Los Angeles—Chavez Ravine	$47,390.43	Griffith Company	Naval Reserve Armory	Plant mixed surfacing on imported base
Los Angeles—Imperial Highway	$167,202.47	J. E. Haddock Inc.	Airplane plant	Widen and surface with plant mix on cement stabilized base
Orange—Baker St.	$127,157.11	Griffith Company	Army aviation training center	Plant-mix surfacing on imported base
Ventura—Port Hueneme	$213,987.78	Basich Bros.	Naval Base	Plant mixed surfacing on existing pavement on portions; plant mixed surfacing on imported base on other sections
Los Angeles—Pearl St.	$20,957.75	Sparks & Mundo	Airplane plant	Resurfacing existing pavement with plant mix
Los Angeles-Mormon Island—La Paloma Ave., Falcon St. and Fries Ave.	$31,019.65	Griffith Company	Port facilities	Portland cement concrete pavement
Los Angeles—E. Broadway, Crenshaw and Doty	$38,883.63	Oswald Bros.	Airplane plants	Grade and surface with plant mix on imported base
Los Angeles—Woodley Ave. and Roscoe Blvd.	$15,077.40	Schroeder & Co.	Naval Air Base	Plant mixed surfacing on imported base
Los Angeles—Ontario St.	$12,641.00	Schroeder & Co.	Airplane plant	Plant mixed surfacing on imported base
Orange—Avenida Dolores	$6,930.70	Sully-Miller	Marine Base	Plant mixed surfacing on existing street
Los Angeles—Clybourn Ave. and Van Owen	$35,345.13	Warren Southwest Inc.	Airplane plant	Plant mixed surfacing on imported base
Orange—Trabuco Rd. and Central Ave.	$101,566.58	W. E. Hall	Marine Air Base	Widen and surface existing pavement with plant mix
Los Angeles—Douglas St., bet. Imperial and 1400 feet Sly	$35,364.60	Olympic Contracting Co.	Airplane plant	Portland cement concrete pavement
Los Angeles—Figueroa St., bet. Anaheim St. and B Sts.; and C St. bet. Hawaiian Ave. and Figueroa St.	$44,534.65	Griffith Company	Shipyards	Widen and pave portions with Portland cement concrete, and resurface existing pavement with plant mix
Orange—Valencia and Red Hill Ave., bet. Neptune and Rte. 2	$59,271.05	State day labor	Navy lighter-than-air base	Grade and surface
Los Angeles—Atlantic and Bandini	$22,555.33	Vido Kovacevich	Army Air Base	Channelize and install traffic signals
Los Angeles—Glenoaks Blvd., Kenmore and Ontario St.	$87,343.80	Day labor, City of Burbank	Airplane plant	Widen; pave with A. C. pavement
Los Angeles—Van Owen bet. Hollywood Way and Clybourn	$20,000.00	Day labor, City of Burbank	Airplane plant	Grade and surface—A. C. pavement
Los Angeles—Woodley Ave. and Saticoy St.	$74,820.68	Griffith Company	Naval Aviation Base	Widen, and pave portions with asphaltic concrete and portions with Portland cement concrete

State of California

EARL WARREN, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

CHARLES H. PURCELL, Director of Public Works

A. H. HENDERSON, Assistant Director

HIGHWAY COMMISSION

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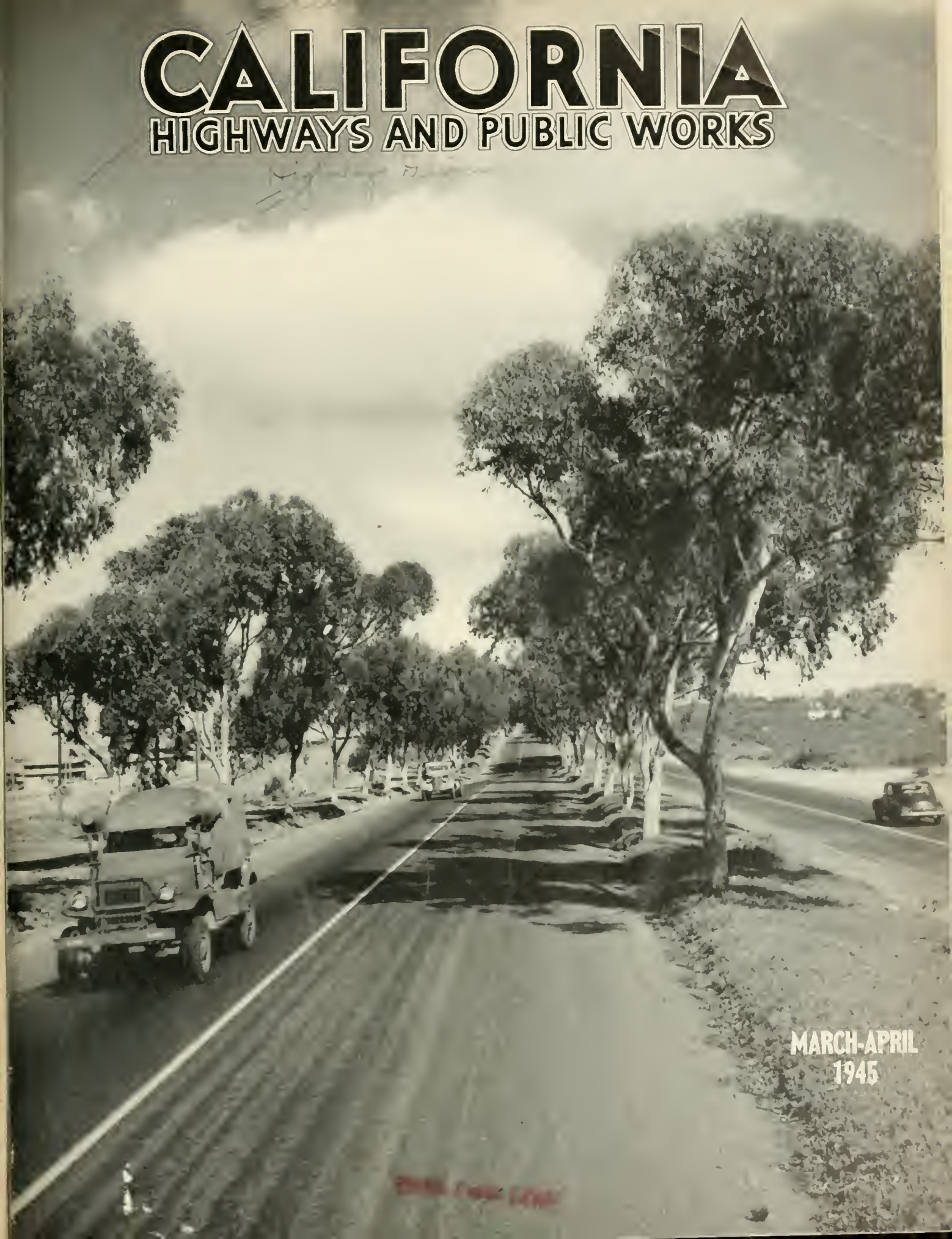
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Primary Routes
Secondary Routes
Proposed Routes

SAN FRANCISCO AND VICINITY

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CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



MARCH-APRIL
1945

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

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Right of Way Problems on Freeways

By FRANK C. BALFOUR, Chief Right of Way Agent

FOR many years, the only available means of controlling the use and development of lands abutting State highways in California, was through the enactment of zoning and set-back ordinances by the city and county officials within whose respective territories the State highway was located.

However, as the volume of traffic using the State highways has continued to increase year by year, it has become more evident to the State Highway Engineer and his staff that to protect the huge past investment in right of way acquisition and construction and to also guarantee future contemplated investments, a satisfactory means of legal control of right of way for the purpose of regulating the traffic must be found.

As a result of exhaustive studies and research, the Legislature in 1939 passed the Freeway Law. A freeway in this State means, "a highway in respect to which the owners of abutting lands have no right of easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access."

In the succeeding statements the terms "full freeway" and "limited freeway" are used. A "full freeway" is one on which all access rights are acquired. Usually a full freeway is located in urban areas where a maximum of congestion, conflicting movements and hazard are encountered. Such a highway, in addition to securing all access rights, is usually developed as a divided road with no opening in the median strip, thus preventing left turns, with grade separations at intersecting roads or streets, and with prohibition against pedestrian traffic.

A "limited freeway" is one on which only limited access rights are acquired from the abutting properties.

FREEWAYS TOTAL 420 MILES

During the several years since this enactment, the California Highway Commission has passed resolutions declaring 420 miles of the State Highway System as freeways. Of this total, 263 miles have been declared full freeways and 156 miles limited freeways.

Of the 124 projects in the present postwar program, 52 have been declared freeways. Of the total of 220.9 miles, 99.8 miles represent full freeways and 121.1 miles, limited freeways.

Approximately 25 miles of full freeway have been constructed in California—the most important being the Arroyo Seco Parkway between the metropolitan business sections of Los Angeles and Pasadena.

The present plan of the California Division of Highways is to convert the two main north and south State arterials (Federal Routes 99 and 101) and the two main east and west arterials (Federal Routes 40 and 60) into freeways, with portions of a third east and west arterial (Federal Route 50) also to be included in this program, thus ultimately making the main arterials in locations where heavy traffic congestion is found, full freeway, with the balance of the alignment limited freeway.

This ambitious program can of course be carried forward to ultimate completion only as rapidly as gasoline tax funds become available for expenditure on these routes.

MANY PROBLEMS

This new type of highway development created many problems in connection with right of way acquisition. Some of the most important questions requiring careful study, were:

1. What is the resulting effect upon properties abutting the State highway when access rights are acquired on a limited basis?
2. What is the effect upon abutting and contiguous properties when right of way is acquired for full freeway construction?
3. What is the effect upon the abutting property when it at present fronts upon the State highway and, as a result of converting the State highway into a full freeway the property will abut upon an outer highway upon completion of the construction program, which outer highway connects with the main through lanes of traffic only at points designated by public authority?
4. What is the effect upon abutting property located at an intersecting cross street when full access rights are taken along the State highway right of way line, leaving access to the property only through means of the county road?
5. What is the effect when a freeway is constructed along new alignment severing existing ownerships which will abut upon the new alignment, into two parcels?
6. What is the effect upon properties fronting upon intersecting cross streets, which cross streets are, because of their minor importance, closed at the freeway right of way line, creating what are familiarly referred to as cul-de-sac streets?

COMPREHENSIVE STUDY

As soon as the importance of these problems became apparent, and because of the vital importance of the answers to both the Division of Highways and the affected property owners, the State Highway Engineer instructed the Right of Way Department to institute a complete and comprehensive study to determine as nearly as possible the facts.

The study has been one in which we have attempted to reach every possible source of information. Invaluable data have been obtained from a number of State Highway Departments and county and city officials, also from Parkway Authorities created for the construction and control of freeways, and numerous other sources in various States including Illinois, Kansas, New York, Massachusetts, Pennsylvania, New Jersey and Kansas; from Westchester County, New York, and from the cities of Detroit, Chicago, Boston, Kansas City, and others.

Information has also been provided by a number of very progressive city and county planning commissions throughout California and other States. An untold number of individuals and firms specializing in modern subdivisions have given us the benefit of their experiences in the creation of the modern type of subdivision where access from main through arterials to their large subdivisions have been limited; where the subdividers in connection with the improvements have constructed outer highways immediately adjacent to the main arterial to serve the subdivisions, with only one or two points of access to the through highway, and where, in numerous modern subdivisions, the first tier of lots back up to the main arterial and front on



the first street next to and paralleling the main highway.

CUL-DE-SAC STREETS

In our contacts with these subdividers, we have been fortunate in many cases in securing the reason subdividers have created numerous cul-de-sacs (dead-end streets) within the subdivision, together with the relative value of lots fronting on these cul-de-sac streets as compared with the value of comparable lots fronting on through streets.

In connection with our study of the value and utilization of lots fronting on cul-de-sac streets as compared to comparable lots fronting on through streets, we have employed real estate valuation experts to assist us and to enable us to secure entirely unbiased opinions in determining the effect upon the reduction in value, if any, of the lots formerly fronting on through streets which, because of the construction of the freeway will upon completion, front upon cul-de-sac streets.

STUDY WILL CONTINUE

We do not feel that our study and research work necessarily at this time give us the final and thoroughly accurate answers, but we propose to continue the study until every shred of factual data has been thoroughly explored. However, we feel that at the present time we have accumulated sufficient information to furnish fairly accurate information and, so far as space will permit, we will outline our present opinions.

It has been difficult to determine the effect of construction of the Arroyo Seco Parkway upon abutting and contiguous properties, for the reason that the parkway was opened to traffic since the inauguration of the National Defense program which was followed by the tremendous war effort, resulting in the most erratic real estate market and possibly the wildest inflationary trend in real estate values in the history of California. As a result our studies on this feature have been on freeways previously constructed in eastern States and cities, principally in and around New York City, Westchester County, New York, Detroit, Michigan, and along the Pennsylvania Turnpike.

HARVARD UNIVERSITY STUDY

In our opinion the most complete and exhaustive study available on this subject was made by the Harvard University, Department of Economics, by John Nolen and Henry V. Hubbard, and published under the title "Parkways and Land Values," by Harvard University Press, Cambridge, Massachusetts.

The acquisition of right of way for limited freeways through rural areas affecting large agricultural properties, roadside business establishments, the rural resident owning a small acreage or perhaps a commercial acre on which he resides and at odd times works his small farm—his principal income being from working in the city, and other rural properties, is of far greater benefit than any damage that is suffered because of the acquisition of access rights on a limited basis.

Some of the reasons are as follows:

In the event of the remote possibility of future subdivision for residential or industrial use, the modern subdivision is so planned that limited access from the subdivision to the main arterial has more advantages than disadvantages, and does not affect the net return to the subdivider.

BENEFITS DERIVED

We live in an age when time is the all-important factor. It follows that in developing a limited freeway through the rural area, stepping up to a full freeway through the urban area and into the metropolitan district of the city, we naturally decrease the traveling time and tremendously increase the safety of the highway, with resulting financial benefit to the farmer and other rural residents.

The already established roadside business enterprise, as will be noted from **Photograph No. 1** showing a drive-in restaurant, is permitted to retain reasonable ingress and egress to the establishment. The taking of limited access along the undeveloped area abutting and contiguous to such establishment minimizes possible future competition, with resulting increase in land and improvement value to the owner.

BENEFICIAL EFFECT

Our studies, and information secured on parkways in numerous other locations, have satisfied us that a freeway properly landscaped, because of its utility and many advantages over the conventional type of surface highway, has a very beneficial effect upon abutting and contiguous properties, with a resulting upward trend in land values.

When an existing highway is converted into a full freeway, with the result that the abutting property now fronting on the through lanes of traffic will of necessity upon completion of construction abut upon an outer highway, with the outer highway connected with the main through lanes of traffic only at points designated by public authority, the economic result upon already established business and industrial properties presents a highly debatable subject. However, it must be kept in mind that there will be no business establishments of any kind abutting upon the through lanes of traffic on the freeway and that practically all freeways are a number of miles in length.

It follows that any motorist desiring to patronize any type of mercantile establishment, whether it be service station, restaurant or other business, must leave the freeway proper; and as freeways become more and more common, the traveling public will adjust itself to this condition and the motorist will probably be more inclined to turn off the freeway into an outer highway at locations where there are several mercantile establishments grouped together.

It is also reasonable to assume that the motorist will leave the freeway and enter the outer highway where and when he needs gas, is hungry, sleepy, or desires to purchase some article.

SOME ADVANTAGES

It follows, generally speaking, from a competitive standpoint that when all business establishments along the freeway front on the outer highway, they are more or less in the same position to each other as they were previous to construction of the freeway.

There is no question but that residential properties fronting on an outer highway immediately adjacent to and parallel with the freeway, rather than fronting on the through lanes of traffic, enjoy many advantages in comfort, safety, and freedom from the annoyance of traffic, especially when the freeway is properly landscaped resulting in the shielding of through lanes of traffic from the outer highway.

Many modern subdividers recognize these advantages and plan their subdivisions so that the first row of lots along the highway either back up to the main arterial and fronts upon the next paralleling street of the subdivision, or the subdivider as a part of the development creates an outer highway. A typical example of this type of outer highway is shown in **Photograph No. 2** which is a portion of the Lakewood Development along State Highway 168 northeasterly of Long Beach, in the vicinity of the Douglass Long Beach airplane factory.

There are many advantages in an industrial subdivision when the industrial property fronts upon an outer highway, or upon the local street immediately adjacent to the through arterial or freeway. There is freedom from the annoyance and confusion of fast moving traffic, loiterers and the danger to employees either as pedestrians or operators of vehicles, and yet the main arterial is immediately adjacent to the plant, permitting fast movement of employees, equipment and produce to and from the factory.

The questions of effect upon abutting property located at an interseeting cross street when full access rights are taken along the State highway right



of way line are to a great extent answered by the preceding discussion of individual problems; and if the intersecting cross street should be converted into a cul-de-sac, the result of our study will be given in the next topic of discussion.

CERTAIN DISADVANTAGES

If by chance the improvement is a limited freeway and the intersecting street will enter the freeway at grade, it would naturally be disadvantageous, if the property were used for roadside business purposes as a service station or drive-in restaurant. If the enterprise is a retail mercantile establishment such as grocery or hardware, there would be little or no disadvantage. The result would depend entirely upon the merchandizing ability of the operator of the establishment. If he is not a progressive merchant he may suffer some damage. If, on the other hand, he is an alert, progressive merchandiser, he will supply off-highway parking facilities for his customers and capitalize on the advantages of the safety feature to his customers in being able to reach his establishment quickly and safely through the use of the limited freeway, with the further safety and convenience of leaving the highway and entering the merchant's private parking lot to transact business.

If the property is used for residential or agricultural purposes, the benefits of the limited freeway will far more than offset the loss of access along the freeway side of the property; and if the property is used for industrial purposes, the same statement would hold true.

QUESTION OF DAMAGES

The question of the effect when a new freeway alignment severs an existing ownership into two parcels, in the case of a limited freeway, has already been answered. In our opinion, the property owner is entitled to the damage, if any, he suffers because of his property being severed into two parcels. Generally speaking, if the affected property is a large ownership, it is reasonable to assume there will be one or more cross-overs in the center division strip within the boundaries of the property, and the limited access openings on each side of the highway are permitted opposite such cross-overs.

If the improvement is a full freeway, and the two severed parcels have access along existing county roads, the property owner might have to follow a circuitous route to get from one portion of his property to the other, as he would obviously not be permitted to travel across the freeway. He enjoys the numerous benefits that accrue to his property because of the location of the freeway, but it requires study of each individual ownership to determine what damage, if any, he suffers over and above the usual severance damage.

DEAD-ENDS

Perhaps the most difficult question to answer is the case where the existing through street is, because of construction of the freeway, dead-ended at the freeway right of way line, creating a cul-de-sac. Our studies on this topic, although exhaustive, are not completed.

Before the final determination is is made that an existing through street will be converted into a dead-end street, at the freeway right of way line, careful study is jointly made by our Design, Traffic and Safety, and Right of Way departments. Full information is secured as to traffic flow, origin and destination, etc., to determine whether a grade separation structure should be built to carry the intersecting street across the freeway or whether the intersecting street should be dead-ended at the freeway; and after the determination of these two questions, whether there is justification for constructing an outer highway to tie the proposed cul-de-sac street into the next paralleling street to permit circuity of travel.

In this phase of the study, careful consideration is given to the convenience and economy of various public agencies in rendering service to the lots abutting upon the street in question, such as garbage disposal, mail delivery, fire protection, public utilities, etc. Consideration is also given to the possible volume of traffic, the convenience of the property owners fronting on the potential cul-de-sac street, and the convenience of the general public.

DIFFERENCE OF OPINION

Furthermore, consideration is given to the cost of construction and maintenance of the tie-in street to permit circuity of travel, so that the cost may be balanced against all other factors for the purpose of determining in the final analysis whether possible damage to the abutting properties because of the creation of a cul-de-sac justifies the cost of construction and maintenance of an outer highway or tie-in street.

In determining the damage, if any, to the abutting property because of the creation of a cul-de-sac, our study and investigation have developed many conflicting and misleading facts and opinions. For example, one large subdivider with a national reputation almost had us convinced that the conversion of a through street into a cul-de-sac would have a very detrimental effect upon abutting residential property and would materially depreciate the market value. However, further investigation developed the fact that this same subdivider, in a new and large subdivision, was intentionally creating numerous cul-de-sac streets and his sales organization and publicity featured the many advantages and safety factors of a residence located on a cul-de-sac as compared to a comparable location on one of the through streets in the subdivision. The lots fronting on the cul-de-sac were priced identically the same as lots of comparable size and located on the through streets.

STUDY OF CUL-DE-SACS

Our study of the effect of cul-de-sac streets upon the market value of properties abutting thereon, has been an extensive one taking us into every one of the larger counties in the State of California, and through numerous eastern states including Nebraska, Illinois, Ohio, New York, Pennsylvania, Missouri, Michigan, New Jersey, Massachusetts, and any other localities where cul-de-sacs could be found. Particular emphasis and careful study were given to large developments such as the Springwells Park Development at Dearborn, Michigan, sponsored by the Ford Foundation; the cul-de-sac street development at Hill, New Hampshire, planned by the State Planning and Development Commission; the development in a section of Radburn, New Jersey; residential development as planned and recommended by the Chicago Plan Commission, and others right here in California, particularly in the metropolitan area of the City of Los Angeles where there are numerous new subdivisions containing many intentionally created cul-de-sac streets.

However, accurate deductions from a market value standpoint have been difficult to make because of the erratic real estate market during the past several years.

MANY CASES CHECKED

Some 75 subdivisions which contained intentionally created cul-de-sac

(Continued on page 28)

Bridge Maintenance Practice In California

By JOHN L. BEATON, Structural Engineering Associate

THERE are 4,636 bridges on the California State Highway System omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is $125,000,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenance and Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the third. It deals with Piling Maintenance.

A VERY vulnerable element of a bridge is its support. Here the designer must consider loads, deterioration due to air borne elements and also the erosive action of the stream, the corrosive action of the earth and attack by various organisms. This article will cover the maintenance problems which arise when any one of the above forces is not sufficiently resisted in the piling type of support to a structure. Abutments, bulkheads and columns will be covered in other issues on Bridge Maintenance Practice.

The piles used in supporting a bridge are of one of the four major types of building materials; steel, concrete, treated timber or untreated timber. Each of these materials has a different maintenance record in the various climatic areas of California. Materials which deteriorate rapidly along the seacoast or in the mountainous regions have, in some cases, a very excellent







record in the large valley or desert regions. The critical section of a pile, no matter what its location, is from two to five feet below the ground up to the bottom of the bearing.

STEEL PILES

Steel piles have been used in State highway bridges for only 14 years and their maintenance has been limited in general to surface painting and to correction of damage caused by floating or moving objects or, in a few cases, corrosion at the ground line. The atmosphere along the coastal regions of California causes rapid deterioration of exposed steel and such action requires frequent inspection and painting if repairs are to be held within reasonable bounds.

A steel H section pile damaged by drift to an extent requiring repair usually is reinforced to resist future impact by placing a reinforced concrete collar around the straightened section. An alternate method might require straightening and reinforcing the section with additional metal. Protection against corrosion at the ground line due to alkali bearing soil has been provided for steel piles by encasing them in reinforced concrete collars. This protection, which covers the portion from four feet below the ground surface to three feet above **(Picture 1)**, has been found to be effective.

CONCRETE PILES

Maintenance and repair of concrete columns offer many diverse and interesting problems, especially in our older concrete bridges built in the early days before the development of more rigid specifications and inspection. One of the results of the lack of uniformity in early day concrete construction is shown in **Picture 2**. This pile was made of poor quality concrete and when first driven, undoubtedly, it was very porous, full of shrinkage cracks and probably had cracked from handling and driving. The structure in which this pile is located is on the seacoast and within 10 years the reinforcing steel was rusting and swelling, causing the concrete to break off. Patching was first attempted but progressive failure has become so serious and extensive throughout the entire structure that after only 28 years of service replacement now is considered necessary.

Impact from external objects also has caused a large amount of the damage to concrete piles. The normal procedure in repairing such damage is to shore up the structure, remove the defective concrete, straighten and perhaps supplement the reinforcing steel, then recast the column to its original line, using concrete having a minimum shrinkage. Concrete piles, if used in streams carrying very heavy boulders, often may be badly shattered or eroded. This is usually repaired by casting the concrete back to its original lines and armoring the danger zone. The armor may be either an additional thickness of dense concrete or may be steel plates or shapes, depending on the post detail.





Typical ground line decay in untreated piles. The removed pile stub was rotted completely about two feet below the ground line as shown in Photo No. 5

TREATED PILING

The maintenance of timber piling offers the engineer an opportunity to show not only his ingenuity in developing details of the repair but also to display his judgment in selection of type, the latter depending primarily on the service life remaining in the superstructure.

Treated piling has in general given very good service in State highway structures. Such deterioration as has occurred in treated piles, before reasonable service was obtained, usually can be attributed directly to faulty construction detail or poor material. Faulty detail includes holes bored or cuts made after treating and improper capping of pile tops. Decay usually will enter the timber at one of the weak points and spread through to the heart. A pile of substandard material will check or split during driving and such cheeks and splits are the opening wedges for the development of rot. Spraying of these openings with wood preservative has been found to retard or prevent this decay.

The pile shown in **Picture 3** shows the results of decay developing from the top because the end was not capped after cutting. This condition usually is corrected by stubbing a new section onto the sound remaining portion of the pile. If there is no necessity in developing the full moment resistance of the pile, the new stub may be placed with a bolted half lap joint. When conditions are such as to make it necessary to restore the original resistance of the pile, a fish plate joint is used or the joint may be encased in a reinforced concrete collar.

TIMBER PILES

In most locations untreated timber piles have a relatively short life, except where they are permanently below water or are in an ideally dry location. Their deterioration is likely to be most rapid in salt water locations where



they are exposed to marine borer action and in any location where the moisture content is held within the range favorable to the growth of decay fungi (somewhat above and near 20 per cent). Decay in timber is inhibited where the moisture content is below 20 per cent, and somewhat retarded between 20 per cent to 30 per cent. Untreated timber used in dry localities with good ventilation and isolated from contact with the earth generally will yield a good service life. If a structure is well proportioned otherwise but placed on untreated posts or piles which are in contact with the ground, usually it will require a major repair job at the ground line in from three to 10 years. The type of repair, of course, depends on the remaining economic service life in the superstructure and may vary from more permanent types of construction to replacement in kind. Immediate temporary shoring, to sustain the structure until more permanent repairs can be made, is often necessary.

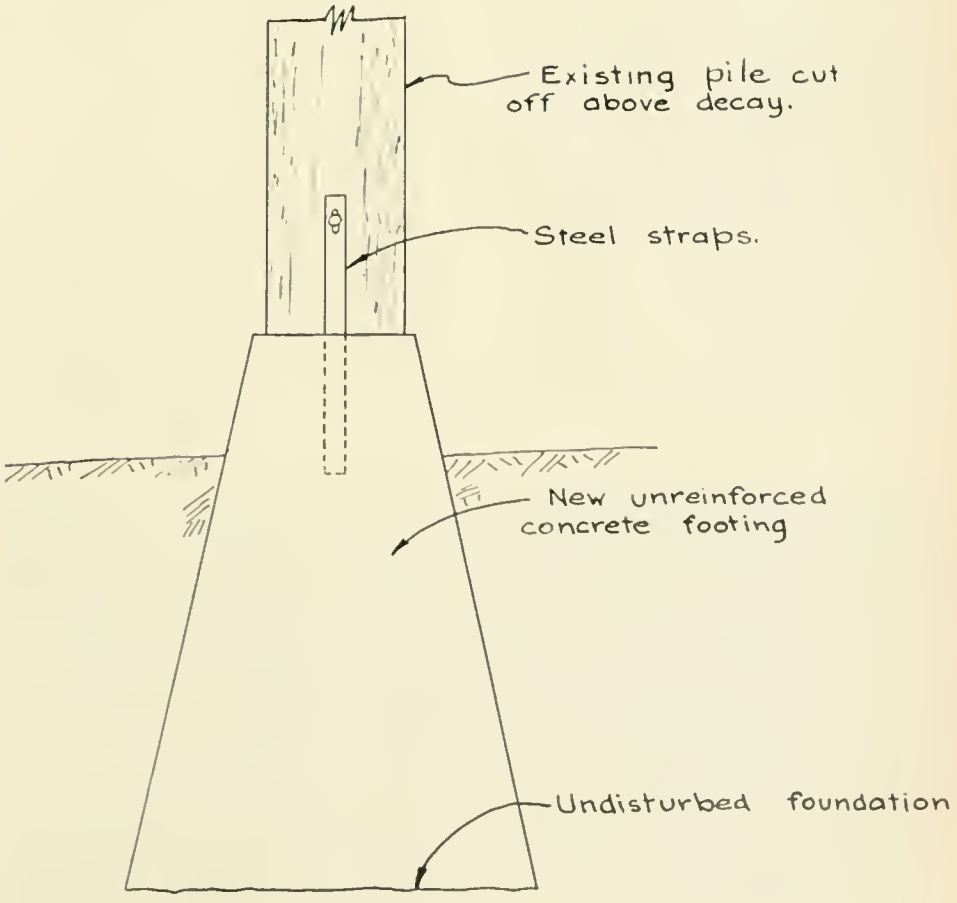
MARINE BORERS

Untreated timber placed in brackish water is subject to attack by marine borers, and may serve less than a year after construction. **Picture 4** shows the reduction in area of a dolphin pile at tide line as a result of marine borer action. The bearing piles were attacked also but repaired. The repair and correction of piling attacked by marine borer action has been accomplished by cleaning the piles and encasing them in concrete. The section so treated is from three feet below the mud line to one foot above high water. The shell usually has a thickness of about six inches and such a repair, shown in **photo 4**, has been in service for about 10 years and the piles are still in good condition. They were infested about four years after original construction.

Picture 5 shows typical ground line decay in untreated piles. The removed pile stub was rotted completely about two feet below the ground line. In some cases the decay starts from an exterior hole below the ground line then penetrates upward through the heart of the pile, resulting in concealed rot instead of the more commonly observed exterior disintegration. The porosity of the soil has a very definite bearing on the position of ground line decay. In a heavy soil the first deterioration is usually at or slightly below the ground line. In a very porous soil, such as deep sand, the rot is at the point of ideal moisture content which may be considerably below the ground line. Since, in sandy soils, enough fresh air can penetrate to reasonable depths where it can sufficiently promote the growth of the decay fungi, the condition of untreated timber must occasionally be examined to depths of as much as 10 feet.

DECAYED POSTS

Typical pedestals for stubbing decayed posts and piles are shown in **Types A and B** and in **pictures 6 and 7**. **Picture 6** shows repairs under way on untreated timber piles after seven years of service (the superstructure was in excellent condition). The general procedure is to remove the decayed sapwood and, if there is enough sound



TYPE A

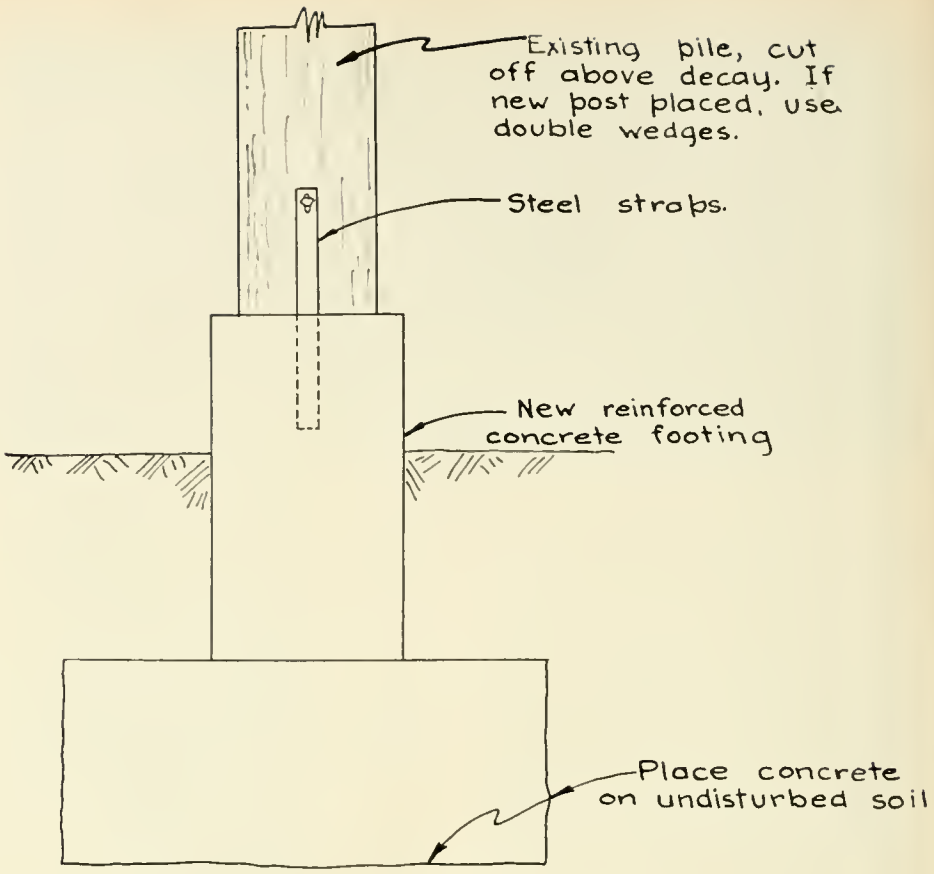
wood remaining, paint the surface with two coats of a wood preservative. The third pile from the left side of the picture had insufficient bearing area, and was stubbed with a **Type B** concrete post and footing. When the repairs, as shown in **photo 6**, were made, it was necessary to stub about 6 per cent of the piles. In the seven years since doing this work, it has been necessary to stub an additional 10 per cent and to completely replace the bulkheads.

AMERICAN RIVER BRIDGE

The American River Bridge on the Fair Oaks Highway is a bridge of similar construction to those noted above, but in a sandy channel. Four years after original placement, the piles were given the ground line treatment described above, while about 3 per cent were stubbed. Eleven years after original construction, it was necessary to repair all of the piles in the bridge. A continuous concrete footing, which supported concrete columns extending about 18 inches above the ground line, was constructed below expected scour. Stub piles of salvaged timber were then used to complete the supports up to the caps. The original piles were left in place as falsework during construction of the concrete bent. This concrete bent had its columns alongside of the existing piles, and by placing new posts on the columns, in the first two bents and salvaged cut-off piles on each succeeding bent, always working toward the shallow end, a very economical job was obtained.

Two new ground line surface treatments have been introduced recently on State bridges. To date no definite conclusions can be drawn relative to these treatments due to lack of sufficient experience data. In both treatments the pile is prepared by excavating to the proper depth and removing all decayed wood then, if sufficient section remains, the surface is treated.

Picture 7 shows the first process wherein the post is daubed with a toxic salt wood preservative and then protected by paper or cloth bandages. The bandage protection is necessary to prevent the toxic salt from washing off the pile. The bandage also holds moisture against the surface so that the salts in solution will penetrate the timber. The second process has been developed and used extensively by one of the major telephone companies and consists of surrounding the pole with earth saturated with a mixture of sodium fluoride, coal tar creosote and other coal tar products.



TYPE B



The conclusion to be drawn from the experience of maintaining piling of bridges throughout the California State Highway System is that preventive maintenance built into the structure in the original design will save many dollars in the way of physical maintenance in the later life of the bridge. An important point which it is hoped this article will bring out is that untreated timber should never be used in contact with the ground, except in short life construction. Like any other engineered structure, the choice of pile type depends on use, locality and economy.

CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

Mission San Buenaventura March 31, 1782

PLANNING the conquest of Upper California, Inspector-General Don Joseph de Galvez, from his Mexican headquarters near La Paz, as early as September 15, 1768, wrote to Father Junipero Serra that the third of the Franciscan stations to be established in the new territory should be named San Buenaventura. The first, Galvez said, would be at San Diego, the second at Monterey and between those two points there should be "the intermediate mission which shall be called San Buenaventura."

However, through no fault of either Galvez or Father Serra, Mission San Buenaventura was the ninth instead of the third mission founded in California. Its creation was delayed 12 years, according to Fr. Engelhardt, because of clashes between the military and the Indians at Mission San Gabriel arising out of mistreatment of the natives by the soldiers there.

San Buenaventura was founded by Father Serra on Easter Sunday March 31, 1782, on a site which had been discovered and claimed for Spain by the great navigator, Juan Rodriguez Cabrillo, on October 10, 1542, 50 years, almost to a day, after the landing of Christopher Columbus.

Cabrillo was hospitably received by the Indians, treated them kindly and then sailed away. Sixty years later, another Spanish explorer, Sebastian Vizcaino, dropped anchor there and later recorded the friendliness of the natives. Vizcaino continued on northward and found Monterey Bay. For 167 years after his departure this section of the future California remained unvisited by white men. And then in the spring of 1769, Gaspar de Portola set out with an expedition from San Diego to relocate Monterey Bay accompanied, as we know, by Fathers Juan Crespi and Francisco Gomez. Once again the white man came to the land that was to become known as San Buenaventura and the discerning Crespi marked it down as a suitable site for a missionary station.

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into northern Washington.

Present day State highways lead to all the mission sites. When the war is ended and California again welcomes tourists from all over the world and there are no longer restrictions on automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways will publish in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions will be taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the fourth of the series.

MISSION IS NAMED

"I named this pueblo Asuncion de Neustra Senora," Father Crespi wrote at the time in his diary, "and I hope that such a good site to which nothing is lacking will be a good Mission through the intercession of this Grand Lady." Father Crespi was impressed by the number of Indians living there and the opportunity offered to win converts to Christianity.

At the feast of Corpus Christi, celebrated for the first time at Mission San Carlos de Monterey on Sunday, May 30, 1771, Junipero Serra, Fr. Presidente of the Missions, appointed Fathers Antonio Paterna and Antonio Cruzado to proceed to Asuncion de Neustra Senora and establish Mission San Buenaventura. The two sailed to San Diego and then set out with Captain Pedro Fages and soldiers for their new field. As we have seen, they arrived at Mission San Gabriel during the Indian revolt against the military and Fages refused to go on, strengthening the garrison of San Gabriel with the troops intended for San Buenaventura.

It was not until March, 1782, that Father Serra, at a conference with Governor Neve at Mission San Gabriel, obtained permission to found San Buenaventura. He marched north with Neve, but before the expedition reached its destination, the Governor was recalled for a campaign against the Yuma Indians and Father Serra went on with Fr. Pedro Cambon and a small bodyguard. On March 31st, Father Serra raised and blessed the Cross on the chosen site, celebrated High Mass in a brushwood shelter with the aid of Fr. Cambon, who constituted the choir, and Mission San Buenaventura came into existence.

FATHER SERRA VISITS

Father Serra remained at San Buenaventura for three weeks and then returned to Monterey from where he dispatched Fathers Francisco Dumetz and Vicente de Santa Maria to the new mission to relieve Father Cambon, who, meantime, had administered the first baptism to the new-born son of Eugenio Valdez, soldier, and Sebastiana Josepha Quintexa, his wife. This was on April 27, 1782.

The old mission register shows that by the end of 1785 there had been 133 baptisms; that in 1786 there were 112 converts during that year, and that in 1796, some thirteen years after the



Mission San Buenaventura, restoration of which extended over a long period of years and which was completed by the Society of Ventura Pioneers and Native Daughters of the Golden West

founding of the mission, the number of baptisms had reached 1,100.

Visiting San Buenaventura in November, 1793, Captain George Vancouver, English navigator and historian, noted in his diary the prosperity of the mission and added that the first church of the station had been destroyed by fire. He gave no date. Fr. Englehardt reached the conclusion from study of the baptismal register that if such a disaster occurred it took place between December 9, 1791, and June 21, 1792.

Fr. Presidente Lasuen reported to the government on March 11, 1795, that the church of San Buenaventura, constructed of masonry, was about half completed and from that date on to September 10, 1809, the mission fathers made frequent reports on progress in the building of the church, granaries, adobe houses for the neophytes, a tannery and other structures, including a chapel for the Indian community near Casita. Solemn High Mass was celebrated for the first time in the new church on September 10, 1809. The first baptism in the new edifice took place on September 30th.

EARTHQUAKE DAMAGE

San Buenaventura was badly damaged by the earthquake of December, 1812, and it was not until July 14, 1815, that restoration work was finished.

In July, the year of the earthquake, Father Jose Senan, senior missionary at San Buenaventura, was appointed Presidente of the Franciscans in California. His labors of love brought remarkable progress to the mission and enrichment of the church and vestry with various church goods, paintings and interior beautification in spite of the fact that from 1811 to the end of the missionary period, San Buenaventura was compelled to pay heavy tribute to the support of the military, which had ceased to receive pay, clothing or food from Mexico as a result of the revolt against Spain.

Already overburdened with worries created by the constant demands of the Santa Barbara presidio, as revealed by the preserved correspondence between him and Captain Jose de la Guerra of the presidio, wherein the priest repeatedly protested against the injustice of throwing support of the soldiers and their families upon the mission Indians, Father Senan was given additional grief by a tragic incident occurring on May 31, 1819.

MOJAVE INDIANS COME

On this day a band of Mojave Indians came from the Sierras of the Colorado River to pay a visit to Father Senan. Doubting the sincerity of the natives, Corporal Rufino Leiva had them incarcerated in the guardhouse. He refused the priest's pleas for their release. The following morning, the corporal punished one of the Mojaves in the stocks and his comrades, in great anger, forced their way out of their prison, killed Leiva and in an ensuing

battle between them and the neophytes and soldiers nine lives were sacrificed. This affair aroused the Indians of the Colorado to fury and for several years they exacted revenge by attacking settlers.

Although a friend of the missionaries, Captain de la Guerra several times sought to obtain mission lands for the government and old records reveal Father Senan's fight to save Rancho de Piru for his charges. An impassioned protest to Governor Sola in February, 1822, evidently won a victory for the missionary for we find the Governor refusing to take Piru from the Indians. Father Senan died on August 24, 1823.

The story of San Buenaventura during the hectic years of Mexican political misrule under successive territorial administrations, which brought about destruction of the California missions and seizure of their lands, is similar to that of the missions dealt with in preceding installments of this little history of the Franciscans. San Buenaventura suffered at the hands of Governor J. M. Echeandia and his successors as did the other missions. However, it appears that this mission was more fortunate than the others in having Rafael Gonzales as civil administrator. Gonzales took over the station in June, 1836, and when William Hartnell, Inspector General of Missions, arrived there in June, 1839, he found the temporal affairs of San Buenaventura in good shape and his inventory showed 2,208 head of cattle, 1,670 sheep, 799 horses, 35 mules, 65 goats and 15 cows.

MISSION RUINED BY PICO

Governor Pio Pico completed the ruin of San Buenaventura. He appointed his brother, Don Andres Pico, and Don Juan Manso as commissioners to "lease the missions." San Buenaventura was leased to Narciso Botello and Jose Arnaz on December 5, 1845, for an annual rental of $1,630, and on June 8, 1846, was sold to Arnaz for $12,000, no part of which Pico paid to the Indians or the mission fathers. The United States Government, following American occupation, declared this and other mission sales illegal and on May 23, 1862, President Lincoln signed the proclamation returning San Buenaventura to the Catholic Church.

First steps toward restoration of the old mission were taken by Fr. John Comopla, who was resident missionary at San Buenaventura from 1861 to 1877. With the advent of the Southern Pacific Railroad in 1887, Fr. Ciprian Rubio started extensive improvements and planned to erect a parish school. The school was not completed until August, 1922, when the Sisters of the Holy Cross took charge. For the preservation of old treasures and relics the Mission Museum adjoining the mission was erected in 1929. Here are the only two wooden mission bells known to have reached California in the days of the early padres. The Society of Ventura Pioneers and the Native Daughters of the Golden West have done much to make San Buenaventura and the Mission Museum the attractions they are today. Back of the mission is the famous Cross on the

Needing water, the Padres who founded Mission San Buenaventura had built with Indian labor a five-mile aqueduct. This photograph shows the ruins of this ancient project. Photo by Byron Dome





View of entrance to San Buenaventura Mission which was founded in 1782

Hill, erected by the Ventura Chamber of Commerce in 1913 to replace the one blown down in 1875, which was the successor to the original cross raised there at an uncertain date. Many believe the first cross was erected by Father Serra, but this Fr. Engelhardt, mission historian, doubts because no mention of it ever was made by Palou, faithful chronicler of Junipero.

Motorists following the "Trail of the Padres" from south to north have the choice of three delightful routes out of Los Angeles to Mission San Buenaventura. One leads through Hollywood and historic Cahuenga Pass over the Coast Highway, U. S. 101, passing Calabasas, then over Conejo Grade and past Camarillo to El Rio, junction of the Coast Highway and Roosevelt Highway, just north of Oxnard, thence about six miles to Ventura and Mission San Buenaventura, which is on Main Street, at Figueroa, close to the business section of the city.

Or, the visitor may leave Los Angeles by way of Wilshire Boulevard to Santa Monica and follow the shoreline along Roosevelt Highway through Oxnard to El Rio, connecting with the Coast Highway to Ventura.

Mission visitors motoring from Los Angeles to Mission San Buenaventura by way of Mission San Fernando follow Broadway to San Fernando Road, thence through Glendale and Burbank to San Fernando where the route is west through Moorpark and Saticoy over State Sign Route 118 to its junction with the Coast Highway just south of Ventura.

Motoring from the north to San Buenaventura, visitors may come down the San Joaquin Valley over the Inland Route, U. S. 99, to Bakersfield, proceed southwest through Taft to Maricopa and follow the new Ventura-Maricopa State Highway, U. S. 399, to Ventura, or they may follow the Coast Highway, U. S. 101, from San Francisco County to Ventura.

Mission Santa Barbara December 4, 1786

SAILING north on his explorations from San Buenaventura, which he had claimed for Spain on October 10, 1542, Juan Rodriguez Cabrillo, brave old navigator, coursed what now is Santa Barbara channel, anchoring at Rincon, Carpinteria, Point Goleta, Canada del Refugio, Gaviota Pass and finally off Cape Galera or Point Concepcion on October 18th. Taking possession of these new lands and San Miguel Island for the Spanish king, Cabrillo could not know that he had discovered the site of the future presidio and Franciscan mission of Santa Barbara.

Sixty years later, Sebastian Vizcaino came by sea to the same locality and on December 3, 1602, gave to the place the name of Santa Barbara in honor of the saint and martyr of that name. And then in 1769, Gaspar de Portola and his expedition arrived there overland from San Diego and Father Juan Crespi wrote to Father Junipero Serra describing in glowing terms the country and its large Indian population. Here, as Father Crespi saw it, was an ideal field for missionary labor.

It was not until September 6, 1772, that Fr. Serra, en route from Monterey to Mission San Gabriel, visited Santa Barbara for the first time. From the moment of his arrival, Junipero had his heart set on establishing there a mission and presidio. It was given to him to found the presidio, but he died before his dream of a great Franciscan station there was realized. According to Fr. Zephyrin Engelhardt, noted mission historian, Fr. Serra's death was hastened by heartbreaking obstacles raised by Governor Neve and the military which delayed the founding of Mission Santa Barbara for four years.





Upper—Mission Santa Barbara, founded by Franciscan Padres on lands claimed by Sebastian Vizcaino on December 3, 1602, more than 180 years before the mission was established

Lower—View of enchanting gardens of Mission Santa Barbara. Byron Dome photo.

Keyed up to a high pitch of zealous enthusiasm by the successful establishment of Mission San Buenaventura, which he founded on March 21, 1782, Fr. Serra in April had joyfully accompanied Governor Neve and a force of 60 soldiers to Santa Barbara. The Fr. Presidente of the Missions was led to believe that the mission and presidio were to be undertaken simultaneously.

FOUNDING POSTPONED

But Governor Neve, an enemy of the missionaries, had other plans. When Fr. Serra, on April 21, 1782, erected a cross at Santa Barbara, built a temporary chapel and altar and blessed the site, he was informed by Neve that his mission must wait until the pre-

(Continued on page 30)

Roadside Business Development Traffic Hazard in District VI

By E. T. SCOTT, District Engineer

ACCIDENT frequency is high along stretches of State highway in District VI where roadside business development is found. Most of the ribbon development lines the highways at approaches to cities, but few of such places of business add to the beauty of the entrance to a city. In almost every case the roadside development constitutes an eyesore and at the same time restricts traffic flow and is the cause of many accidents.

The "traffic profile" shown here depicts graphically conditions along highway U. S. 99 through this district. It extends from the Los Angeles-Kern County line on the south to the Madera-Merced County line on the north, a distance of 189 miles. It covers conditions as of November, 1941, when traffic volumes and behavior were normal.

At the top of the "traffic profile" the number of pavement lanes extending between the various local points is shown. Traffic volumes counted in July, 1940 and 1941 are recorded graphically. The figures indicate total traffic of which from 20 per cent to 25 per cent along this section of highway are trucks.

HEAVIER NEAR CITIES

As would be expected, traffic increased in the vicinity of urban areas. Approaching the City of Fresno where urban development is the greatest, the traffic volume is the highest. The second greatest urban development is at Bakersfield, where also is found the second largest traffic volume.

The total number of accidents for the three-year period 1939, 1940 and 1941 is shown for each mile along the 189 miles covered by the "traffic profile," except those accidents occurring within the limits of the various cities. The "traffic profile" shows where fatal accidents have occurred and the number of such accidents, also where pedestrian accidents have occurred most frequently.

In Kern County between Fort Tejon and a point about one mile northerly of Grapevine the "profile" shows a large number of accidents and fatalities. Along this 5-mile section of highway there is a sustained 6 per cent grade. The great differential in speed between fast moving autos and slow moving trucks on this comparatively steep grade accounted for most of the accidents. Many head-on accidents occurred on this three-lane section of highway.

ACCIDENT RATE CUT

The "traffic profile" indicated the necessity of improving Grapevine grade, from a standpoint of safety if for no other reason. The three-lane pavement on the 6 per cent grade was widened to a four-lane divided highway, with a center barrier railing to keep opposing lanes of traffic apart. The reduction in accidents on this short stretch of highway has more than justified the improvement made.

Many and varied conditions contribute to a high accident frequency. The long Grapevine grade with the slow moving trucks and high speed autos is an example. While no attempt will be made to describe the various conditions which cause traffic accidents, it may be pointed out that in this portion of the San Joaquin Valley at least, roadside business development is responsible for a tremendous increase in the number of traffic accidents.

Between Greenfield and Bakersfield numerous places of business line U. S. 99 Highway. This roadside development becomes very dense close to the city with the resulting high accident frequency for both vehicles and pedestrians. Northerly from Bakersfield where the Kern River bridge and its approaches prevent roadside development, places of business are fewer and more scattered. The number of accidents along this section of highway is correspondingly lower.

Roadside development on the highway approaches to Delano, a city of about 5,000 population, is to be found entirely within the city limits. The "traffic profile" does not show accidents within the limits of incorporated cities.

EXAMPLE AT TULARE

A striking example of the effect of roadside development on a major highway is found on U. S. 99 immediately south of the City of Tulare, which has a population of nearly 10,000. The "ribbon development" lines both sides of the highway, but is confined to the first mile south of the city limits.

This mile long sliver community lying entirely outside of Tulare, is locally known as "Tuggleville." From the standpoint of the motorists, this community and all such major highway "ribbon" communities might well be named "Struggleville." The traffic has to struggle to get through such bottlenecks and the engineers sooner or later have to struggle to find an alternate route into the city in order to eliminate such restricted and hazardous stretches along main highway routes.

Referring to our accident records and to the "traffic profile" it is found that along the mile of highway through Tuggleville, where a dense and unsightly roadside development is found, there were during the three-year period, 1939, 1940 and 1941, 44 traffic accidents. Of the 44 accidents eight were fatal. During the same period, but along the next mile immediately south of Tuggleville, and with practically the same traffic volume, there were only 12 accidents with no fatalities. The motorist and the pedestrian surely pay dearly because of such improperly located business districts.

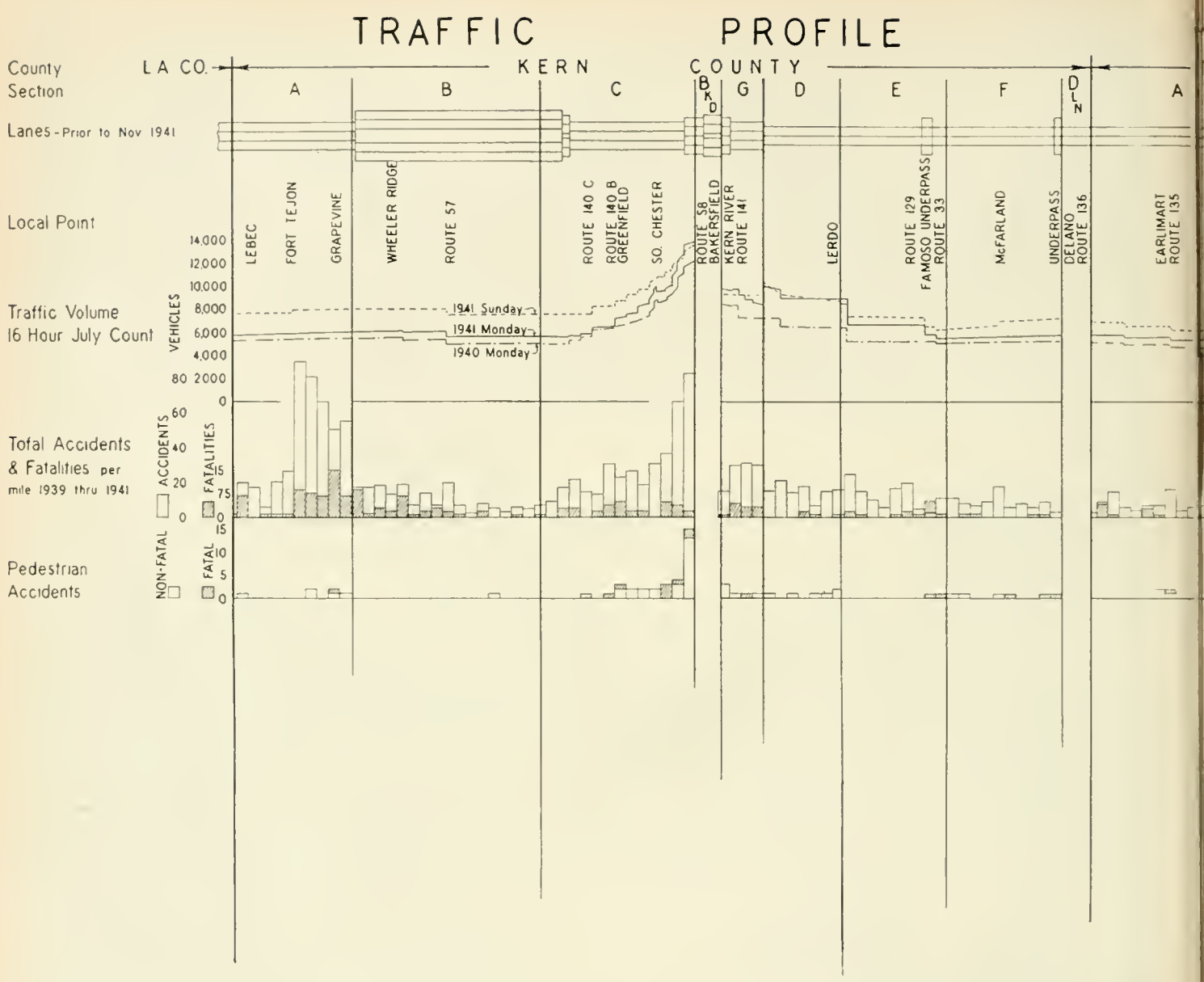
FRESNO CONGESTION

Highway U. S. 99 in the vicinity of Fresno, the largest city in this district, is lined with roadside development both northerly and southerly of the city. Along both approaches to the city the highway is adjacent to and parallels the Southern Pacific railroad and thus roadside business development is limited to the westerly side of the highway only. In spite of this fact, as indicated by the "traffic profile," the number of accidents both vehicular and pedestrian, is very high.

While some of the accidents occurred at county road intersections, still there



Upper—U. S. Highway through Tuggleville, southerly approach to city of Tulare, where uncontrolled vehicle movements cause many accidents. Center—Unsightly business development along major traffic artery south of Tulare, where accidents frequently occur. Lower—Looking westerly from west city limits of Visalia. This entrance to Visalia is almost entirely free of roadside developments.



is every indication that the roadside business development contributes greatly to the accident toll along the main entrances to Fresno. In many of the accidents trucks are involved. Trucks, many of which are bringing farm commodities to market, are required to run the gauntlet while attempting to enter the city.

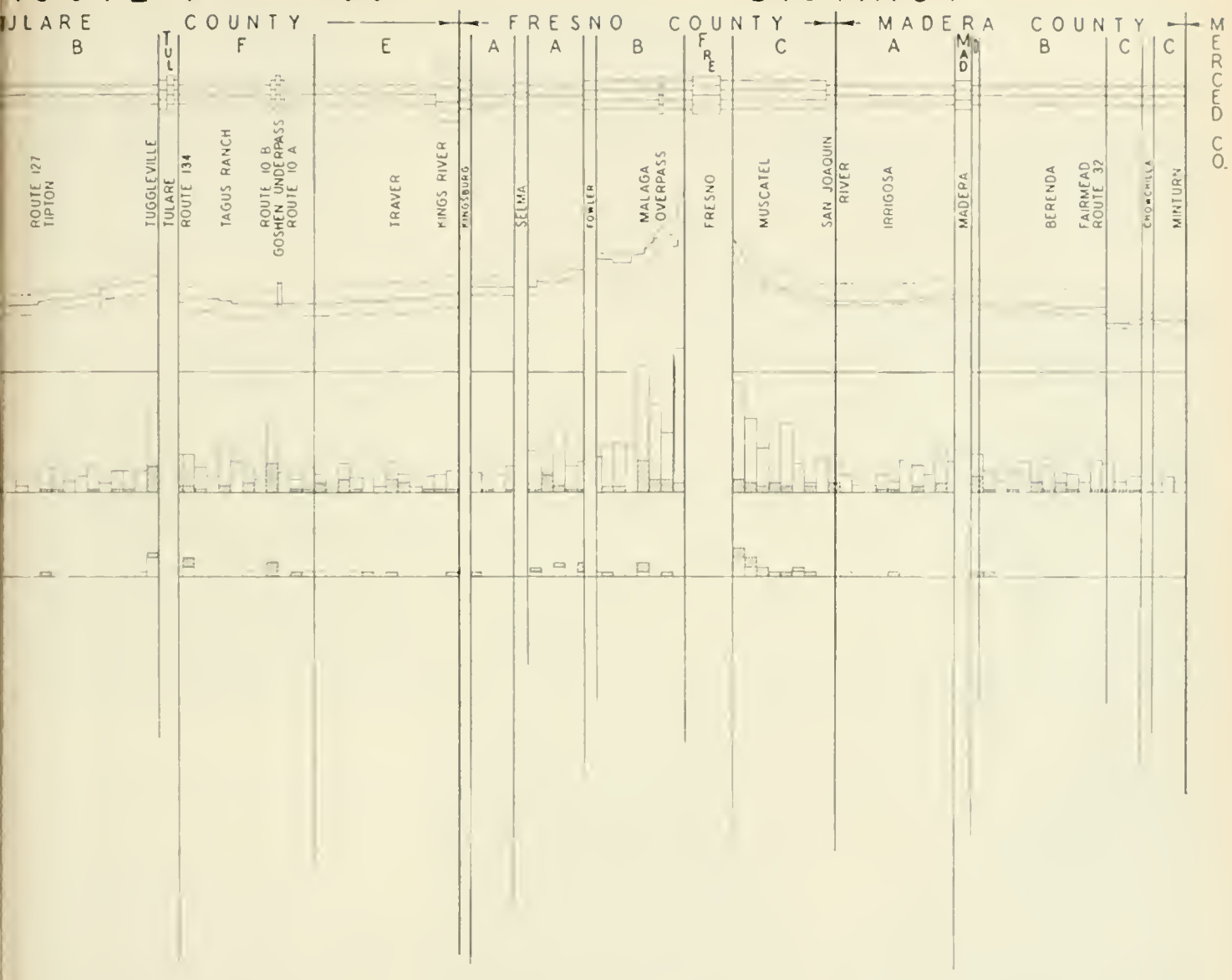
The section of State highway between Fowler and Fresno, compared with all other sections of State highway in the entire State, held second place in 1940 and third place in 1941, for number of truck accidents. For the same years the greatest number of truck accidents on any given section of highway occurred on the Grapevine Grade already referred to in this article. Fortunately this latter situation was corrected early in 1943 by the widening of the three-lane pavement to a four-lane divided highway.

RELOCATION PLANNED

Because of the heavy traffic and the high accident frequency resulting largely from roadside business development, the existing southerly approach of U. S. 99 into Fresno will be relocated. To attempt to widen the existing highway and convert it into a freeway would not be feasible because of the dense roadside business development.

The proposed improvement, set up as a postwar project, contemplates the construction of a freeway paralleling the existing highway but located several hundred feet westerly thereof. No business establishments will be permitted along the new location and it is planned to landscape the proposed four-lane divided highway. Fresno will be provided with a new approach highway that will be free of unsightly roadside development and the hazard which now exists on the present highway will be eliminated. Motorists will be able to drive safely into Fresno along a landscaped freeway.

Northerly from Fresno along U. S. 99 there are many roadside inns or motels and other establishments. These places are subjected to the constant roar of heavy trucks which make up a considerable percentage of the traffic total. That the guests and patrons of these various roadside establishments are subjected to the risk of collision with through traffic is manifested by the great number of accidents occurring along this stretch of highway.



A glance at the "traffic profile" will show the number of fatalities resulting from such accidents. With the existence of the present unlimited access to the highway from the large number of roadside establishments, many accidents will continue to occur along this section of highway.

SPEED CHECKS INEFFECTIVE

The restricted speed zones which have been established by law and which are to be found along most of the sections of highway described in this article, apparently have but little, if any effect on the number of accidents. Such slow speed zones greatly reduce the efficiency of the highway as a transportation route at a considerable cost to the motorists. (In this district at least they are not accomplishing to any great extent that for which they were designed.) Traffic accidents continue to occur where business development lines the highways in spite of the restricted speed zones.

While many of the State highways in this district approaching cities are relatively free of roadside development and free of the accompanying toll of accidents, we wonder just how long such favorable conditions will prevail.

BEAUTY AT ROADSIDES

A striking example of such a highway is the beautiful entrance to an important city over a section of the State artery known as the Sierra-to-the-Sea Highway. Along this section of highway west of the City of Visalia are many fine oak trees of various sizes. The roadsides for several miles are practically free of any business establishments. The view afforded motorists entering or leaving the city is most pleasing. It is to be hoped that something can be done to prevent this beautiful highway from becoming cluttered with unsightly roadside business development and slipping into the category of a hazardous stretch of State highway.

There may be cases where outlying business development is required to serve the needs of the community. A few of the roadside improvements draw business from motorists on the highway. However, in this district there are a great many places of business on main highways that cater to local residents rather than the motorists traveling the highways. Food markets, lumber yards, restaurants and other estab-





Upper—State Highway Route 10 looking toward the city from west city limits of Visalia along Mineral Kind, now relatively free of roadside developments

Lower—View on beautiful Orange Belt Scenic Highway at westerly approach to city of Lindsay. It is hoped these sections of highway can be kept free of unsightly roadside development

lishments do business primarily with persons residing in the immediate vicinity.

While the assessed valuation of the property along the highways just outside the city is lower than that within the city boundaries and the corresponding taxes are much lower, still this saving by owners of roadside development is more than offset by the loss to many thousands of motorists due to the interference with the traffic flow and resulting from traffic accidents.

The question of equity may well be considered here. Is it proper for the motorists to pay for the improvement and maintenance of highways while property owners along such routes profit without contributing to the development?

Proper planning by county planning commissions will help to relieve the conditions so prevalent in District VI of the State Division of Highways.

Vallejo-Napa Highway Underpass Christened

By P. O. HARDING, District Engineer

WHEN the Navy in the spring of 1942 requested, through the Mare Island Yard, a naval access project for constructing two additional lanes of concrete pavement between Vallejo and Napa, the Basalt Rock Company of Napa immediately proposed a change in the grade of the highway which would permit clearance for an underpass to be used solely by their company for truck transport from its quarry east of the highway to the Napa River to the west. The company proposed to pay for the entire difference in cost of constructing the two new lanes at existing grade and the cost of constructing to the revised grade, including the cost of raising the existing two lanes, plus the full cost of the underpass.

It was in June, 1924, that the rock company, through its president, Al G. Streblow, applied to District Engineer John H. Skeggs of District IV for and was granted a permit to construct an overhead bucket cableway from the quarry east of the highway to rail and water shipment facilities on the Napa River. The conveyor has for many years been inadequate to handle a constantly expanding rock movement, particularly the large volume of riprap presently required by the Navy in its many facilities in the San Francisco Bay area. Many heavily loaded trucks had to supplement this movement and in doing so entered the highway at a point about one-fourth mile from the point of exit to the south. The possibility of eliminating the conveyor and improving the traffic situation at this point of congestion on the important Vallejo-Napa State Highway has been discussed for several years.

District X was requested to handle this project with other access projects of this area, as explained in an article in the September-October 1944 issue of CALIFORNIA HIGHWAYS AND PUBLIC WORKS. An agreement was executed between the company and the State in which the State was to design and supervise construction and the company was to actually construct the underpass and grade a contiguous section of the highway approximately one-half mile in length. On completion, the underpass was to be deeded to the State.

SUBWAY DEDICATED

Dedication ceremonies to commemorate the fulfillment of obligations by both parties were held on Saturday, January 27th, in connection with the launching by the Basalt Rock Company of its eighty-fifth hull, the thirty-fifth self-propelled ship constructed for the war effort. In attendance were

Looking south on new Vallejo-Napa highway at point where Basalt Company subway crosses beneath highway





This view of the Vallejo-Napa highway is looking north from Basalt Company Plant

Mrs. George T. McCoy, wife of State Highway Engineer, christens Basalt subway



Director of Public Works C. H. Purcell, State Highway Engineer George T. McCoy and members of his staff. District Engineer Skeggs, and several high ranking naval officers. Mrs. George T. McCoy, wife of the State Highway Engineer, christened the new subway with the traditional bottle of champagne. Mr. Ed. Brovelli, a charter member of the Rock Company's organization, acted as master of ceremonies.

The Mare Island Navy Yard, with its large number of employees and its extensive system of bus transportation throughout the several counties adjacent to the Vallejo area, has been the predominant factor requiring the highway improvement, and the Basalt shipyards, two miles south of Napa on State Route 8, which employs about 4,000 men and women working in three shifts extending around the clock, contributed to the traffic congestion on the north end of this important highway. Numerous other Army and Navy installations in the area have also complicated the traffic problem. The railroads have no passenger service between Vallejo and Napa.

Highway Commission and City of San Diego Open New Access Highway Project

ON February 15, 1945, the California Highway Commission met in San Diego in a joint session and conference with the Arizona Highway Commission, to consider various highway problems of common interest to both States.

At that time an important access highway which had been certified by the Commandant of the Eleventh Naval District as being essential to the war effort, was practically completed and ready to open to traffic. This highway was constructed to furnish better access to military, naval and defense activities along the harbor frontage from the residential sections in Mission Hills and East San Diego. It connects with Washington Street, extending to the east in Mission Hills, thence to a connection with US Highway 101, designated as Pacific Highway, at Harasthy Street.

The project was certified by the Commandant of the Eleventh Naval District on September 3, 1943, following which surveys and plans were made by District XI of the State Division of Highways, and the project was advertised for bids on March 21, 1944, with a time limit extending to March 20, 1945. The contractor on the project was Ralph O. Dixson of Alhambra, and the Resident Engineer supervising the construction work was Frank Jorgensen.

The project provided for the grading of a 68-foot roadbed, on which was constructed a four-lane, divided highway with channelized and traffic actuated signalized intersections, and with most of the location on less than 5 per cent gradient.

Because of the narrow width of the streets with which the project connects at its easterly end, it was necessary to furnish adequate connections to both Washington Street and Douglass Street. The on-ramp from Douglass Street includes a highway grade separation, crossing over Washington Street by means of a reinforced

Douglass Street overcrossing of the Washington Street connection of new access road constructed for the Navy in San Diego



concrete structure 22 feet wide and 270 feet in length, on curved alignment.

The project involved reconstruction of a considerable portion of a major sewer system through the canyon, together with a rather elaborate storm drain system.

COST OF PROJECT

Ninety-nine parcels of rights of way were acquired at a cost of approximately $175,000, and the total cost of the project, including rights of way and all other expenses, amounted to some $561,600.

The City of San Diego contributed $196,000 toward the total cost of the project, and the balance of the funds was provided by the Federal Government under the Access Defense Highway Act of 1941.

The completion of this project provides a highway connection to the harbor front on easy grades which can be negotiated by buses and heavy truck traffic, and will greatly reduce travel mileage to and from defense activities in this area.

DEDICATION EXERCISES

Opening of the highway and the dedication exercises were held on the overpass on the afternoon of February 15th and were participated in by city officials, members of the Highway Commission, the San Diego Chamber of Commerce, and representatives from the Eleventh Naval District. Music was supplied by the Marine Corps Band.

The ribbon was cut by Mayor Harley E. Knox, who was assisted by Director of Public Works C. H. Purcell and State Highway Commissioner C. Arnholt Smith, after which the project was opened to traffic, and guests were taken by bus over the "Freeway" and on a tour of the naval establishments in the San Diego area.

COMMISSIONER SMITH'S REMARKS

Speaking as Highway Commissioner from San Diego, Mr. Smith said:

"It is gratifying to me, as a member of the State Highway Commission, to witness the dedication of this new improvement in my home town. This should serve as an example of teamwork between the Federal Government, the State of California, and the City of San Diego; the kind of teamwork that will be needed to solve the many problems of the expansion of industry on the west coast.

"War is rapidly changing the face of our community, and from the highway point of view it is a change for the better. We need only to look about us to realize the improvements that have been made in our network of roads. These are improvements that will not be lost after the war activity subsides but will remain to serve the increasing load of commerce and traffic.

"These projects are a part of the greater San Diego of tomorrow, a city which will retain a good part of its industrial expansion by more of the kind of planning that went into the construction of this freeway.

"Despite the complexities of this undertaking, it has been rapidly carried through to completion by cooperative spirit to ease the strain placed on our inadequate roads leading from the aviation and naval expansion along the water front of the city.

"For this performance, I should like to congratulate Mr. Ralph O. Dixson, every official of the city, the State and the Federal Government who played an important part in the completion of this major improvement. Particular praise is due to our late City Manager Walter Cooper, to District Engineer E. E. Wallace, to the

This is another view of Douglass Street extension from near India Street, indicating method of utilizing an unimproved canyon for major highway location





California and Arizona State Highway Commissions in joint session in San Diego. From left to right, seated: District Highway Engineer E. E. Wallace; A. P. Dean, U. S. Forestry; Fred Rhodes, San Diego City Manager. Standing: Dean Howell, Assemblyman Charles Stream, Robert Apitz, San Diego Chamber of Commerce, Mayor Harley Knox, Col. Norman E. True, U. S. M. C., Assemblywoman Kathryn T. Niehouse, Col. P. H. Ottosen, U. S. A., Capt. Alden K. Fogg, U. S. N., Col. Joseph E. Campbell, U. S. A., California State Highway Engineer George T. McCoy, Arizona State Highway Engineer Bernard Touhey; Assistant State Highway Engineer of California Fred J. Grumm, Richard H. Wilson, Office Engineer, Division of Highways; Ridgeway M. Gillis, Construction Engineer, Division of Highways; Frank C. Balfour, Chief Right of Way Agent. Seated at rostrum, left to right: H. O. Pace, Chairman, Arizona Highway Commission; Charles H. Purcell, Director California Department of Public Works and Chairman State Highway Commission; Arizona Highway Commissioner J. M. Smith; State Senator Ed J. Fletcher; C. C. Carleton, Chief Attorney, Division of Highways. Foreground, left to right: California Highway Commissioners Harrison R. Baker, Homer P. Brown, James Guthrie; Arizona Highway Commissioner D. Farr, California Highway Commissioners C. Arnholt Smith and Chester H. Warlow, and Arizona Highway Commissioner M. Foreman

present City Manager, Fred Rhodes, to George T. McCoy, State Highway Engineer of California, and many other Government, State and city officials for their untiring devotion to duty in the planning and the completion of this work.

"This great freeway stands as a monument to their efforts, performed quietly and often under great handicaps. Public service such as this is making San Diego an outstanding city and California one of the leading States in the Nation.

"I am confident that no one will question the part that Walter Cooper played in bringing this project into reality, and in recognition of the spirit of cooperation which he symbolized, I hope that further consideration will be given to the designation of this magnificent roadway as the 'Walter Cooper Freeway' in honor and in memory of one of our most beloved and outstanding citizens."

"Just think of it; steak only 20 cents a pound, eggs 15 cents a dozen, chicken 10 cents a pound and milk five cents a quart."

"Where?"

"Oh, nowhere, but just think of it."

National System of Interstate Routes Planned

EACH State highway department has been requested to proceed at once with a designation of routes for inclusion in the National System of Interstate Highways, it was announced by Thomas H. MacDonald, Commissioner of Public Roads. The designation is to be made in accordance with the Federal-Aid Highway Act of 1944 which requires that: "There shall be designated within the Continental United States a National System of Interstate Highways not exceeding forty thousand miles in total extent so located as to connect by routes as direct as practicable, the principal metropolitan areas, cities, and industrial centers, to serve the National defense and to connect at suitable border points with routes of continental importance in the Dominion of Canada and the Republic of Mexico."

The act requires that: "The routes of the National System of Interstate Highways shall be selected by joint action of the State Highway Departments of each State and the adjoining States, as provided by the Federal Highway Act of November 9, 1921, for the selection of the Federal-aid system."

Under this provision, the Administrator of the Federal Works Agency is authorized to approve routes proposed by the State Highway Departments for inclusion in the National System of Interstate Highways.

In making the announcement Commissioner MacDonald said, "Designation of the system is an important step toward launching a large postwar highway program. Construction of such a system is an outstanding feature of the long-range highway program. The recent Federal legislation authorizes $225,000,000 for the Federal-aid Highway System and $125,000,000 for urban highways in each of the first three postwar fiscal years. These funds will be available for improvement of the National Interstate System and other highways."

Free Flow of Traffic on or off Freeways Presents Many Problems

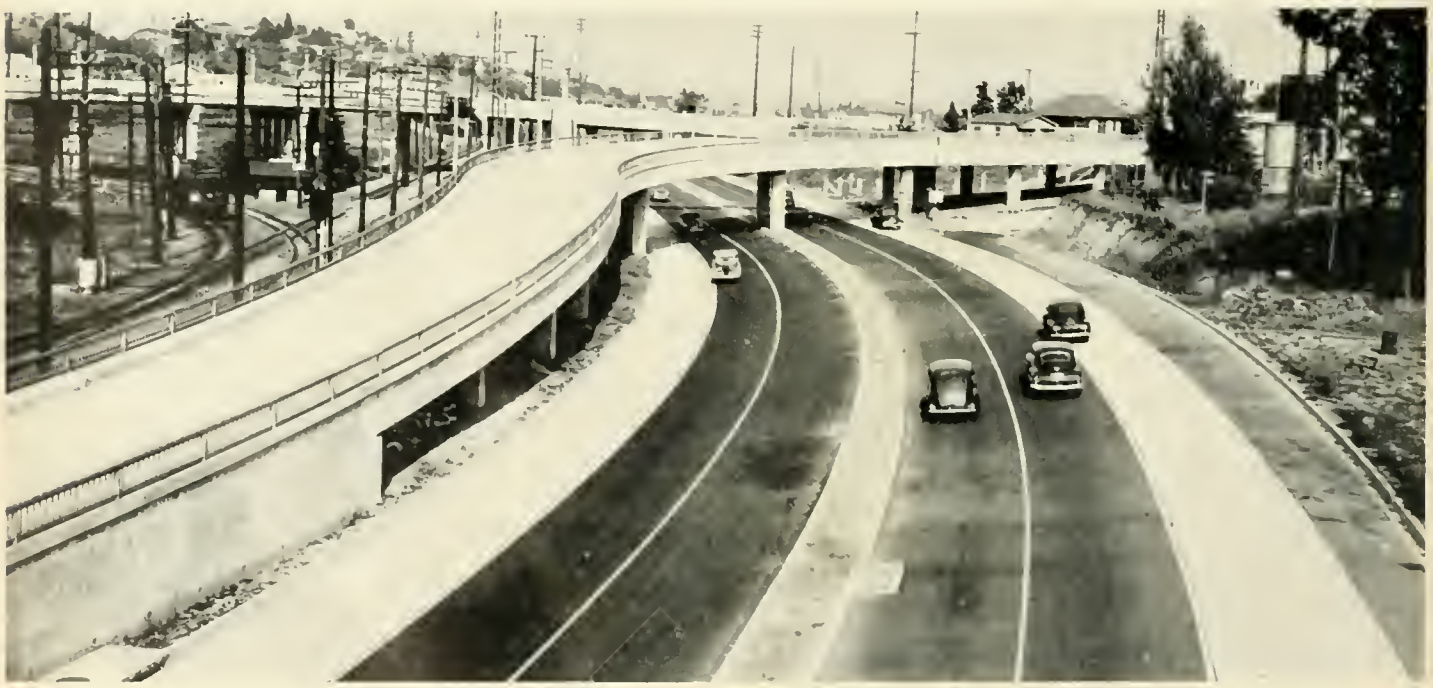


This photo shows Pomeroy Street Off-Ramp. The view is looking west on Ramona Freeway. The off-ramp to Soto Street starts on right and crosses freeway. Soto Street overhead crossing in background

IN metropolitan areas, provision for a free flow of traffic on or off a freeway presents many difficult problems to the engineer. Connections with the freeway must meet the alignment of the existing streets in a manner that will permit traffic to move with reasonable speed and safety and will keep property damage down to a reasonable figure.

Since those who laid out the existing streets had no premonition of a future freeway in the vicinity, it is very likely that these streets will approach the freeway at inconvenient angles and

Pomeroy On-Ramp. View is looking east at on-ramp from Pomeroy Street with Marengo Street overcrossing in the background





This view is looking east under Pomeroy Street On-Ramp at Cornwell Street overcrossing and shows type of structure which was required

intersections will occur at undesirable points. To add to the difficulties, a railroad or car line may have been placed close by. Access to the adjacent property must be provided.

All these requirements seriously cramp the engineer's style but making the best of such unfavorable conditions is his job.

Getting traffic off or on a freeway without interference to traffic nearly always requires structures of some form or other. Such structures should be designed so as to have a minimum of features which distract the attention of drivers. Heavy walls or piers close by the roadway, dark corners or pockets, and a heterogeneous assembly of trusses and girders produce a feeling of constriction or uneasiness. Furthermore, in order to conform with the general effort to beautify the roadsides, the aesthetics of the structures must be given serious consideration.

The pictures which accompany this article illustrate a case where the structures used in providing suitable connections with a freeway are laid out and designed with a minimum of features that tend to restrict the free flow of traffic. Also, they are pleasing in appearance because of their simplicity and flowing lines.

The location is along the Ramona Freeway in the vicinity of Cornwell, Marengo and Soto Streets in Los Angeles. These three streets are carried over the freeway on concrete structures and also over the adjacent tracks of the Pacific Electric Railway.

It was found necessary to provide connections between the freeway and Soto Street; and also between it and Pomeroy Street which is located between the Cornwell and Marengo Street crossings. The curvature of the freeway, the proximity of the tracks, and the angles between the side streets and the freeway presented a difficult situation that is obvious from the pictures.

The type of structure used on the connecting ramps has columns as small as structural safety and appearance will permit and has a smooth slab surface over the roadway. These features very materially minimize the feeling of restriction that normally occurs when approaching overhead structures. The plain lines of the columns and flowing lines of the superstructure offer a minimum of features to distract the driver's attention.

Col. E. J. Murray Awarded Bronze Star for Heroism

One of more than 300 engineers of the Division of Highways now serving in the armed forces, Col. Edward J. Murray of Sacramento, Assistant Bridge Engineer on military leave, has been awarded the bronze star for meritorious conduct in connection with military operations against the Japanese on Luzon from January 9th to February 9th.

Colonel Murray commanded a regimental combat unit in the assault landing at Lingayen Beach and in subsequent operations preparatory to the attack on the enemy's main battle positions in the foothills of the Zambales Mountains.

Colonel Murray, who until 1941 was Commander of the 184th (Sacramento) Regiment of the National Guard, went overseas in 1942 and has seen active service in the Hawaiian Islands, Guadalcanal and New Britain as well as the Philippines. He is now Civil Affairs Officer in the Headquarters of the 40th Division on Panay.

District IV Improves Mechanical Spreading and Finishing Machine

By EARL WITHYCOMBE, Assistant Construction Engineer

CONSIDERABLE difficulty has been experienced at various times throughout the State with that type of spreading and finishing machine employing the vibratory tamper principle of spreading and partially compacting the mixture without the use of side forms.

VIBRATION CONTROL

This type of machine has come into more or less general use in the west to spread plant mix, primarily, but has also been used extensively of late to spread asphalt concrete as well. Such machines have the advantage in the time of war of employing a minimum of manpower, which is an all essential feature.

The quality of work performed by these machines is not up to the standard of that obtained by former methods. However, the uniformity is good. As with all mechanical equipment, the results obtained depend to a great extent upon the skill of the operator and in this respect these machines are no different than that of any other mechanical spreader.

The vibratory tamper unit is in two sections, each being driven by a separate V-belt drive. Although both belts are driven from a common shaft and adjustments are provided for regulating the belt tension, the adjustments are not sufficient to insure that both sections of the tamper are always driven at the same speed, and periodic vibrations are set up in the machine, causing undulations in the resulting surface. These undulations are somewhat similar, although to a much lesser degree, to the effect made on a freshly spread bituminous mixture by driving a crawler tractor over it.

Last summer a fairly new spreader was in service on State Route 1 in Marin County, laying a 3-inch asphalt concrete pavement in two 1½-inch lifts. Mechanical adjustments failed to correct the vibrations, causing pavement roughness. Resident Engineer H. A. Simard refused to permit the machine to be used on surface work until this condition was corrected. Superintendent Bill Russell for Contractor A. G. Raisch, devised and had constructed a flexible coupler tying the two tamper shafts together. This coupling is flexible enough to permit crowning of the tamper bars but rigid enough to hold them in perfect sequence, thereby eliminating the periodic vibration caused by unequal speeds.

As illustrated in **Figure I**, the device consists of placing a cap over the end of each tamper shaft and fastening it with keys. Three holes are drilled in each cap at 120 degrees spacing, and, when assembled, the holes in one cap are spaced at 60 degrees from the holes in the other cap. Holes of the same diameter were also drilled in a piece of ¾-inch "Thermoid" at 60 degrees spacing. Sets of three pins each were tapped into each cap and the "Thermoid" disc fitted into place over the pins. This device functions entirely satisfactorily but is somewhat difficult to install.

A later development was installed on machines operating on contracts on State Route 75 in Contra Costa County. These devices were almost identical in that the six cast holes, 1 15/16-inch in diameter, in the pulley wheels, were connected with three bolts fastened rigidly to one pulley and inserted in the other pulley through a flexible bushing, as illustrated in **Figure II**. This device has the advantage that it can be installed readily, but the wear on the flexible bushing is considerable.

Consideration might also be given to the use of a splined universal joint in connecting the two sections of tamper driving mechanisms.

SHAPER FOR SHOULDER

Another problem that spreading and finishing machines have had to meet is the forming of shoulder tapers on resurfacing projects. In resurfacing on the open highway, where curb and gutter do not exist, it is necessary to feather out onto the existing shoulder with a wedge of mixture usually 2 feet in width, for resurfacing not exceeding 3 inches in thickness and with a depth at the outer edge of 0.08 foot.

In resurfacing with a greater thickness, the lower courses are extended over the shoulder for a correspondingly greater width and with the same slope as the surfacing. These tapers were first formed by hand, then by drags of various descriptions and finally by shapers attached rigidly to the spreading and finishing machine.

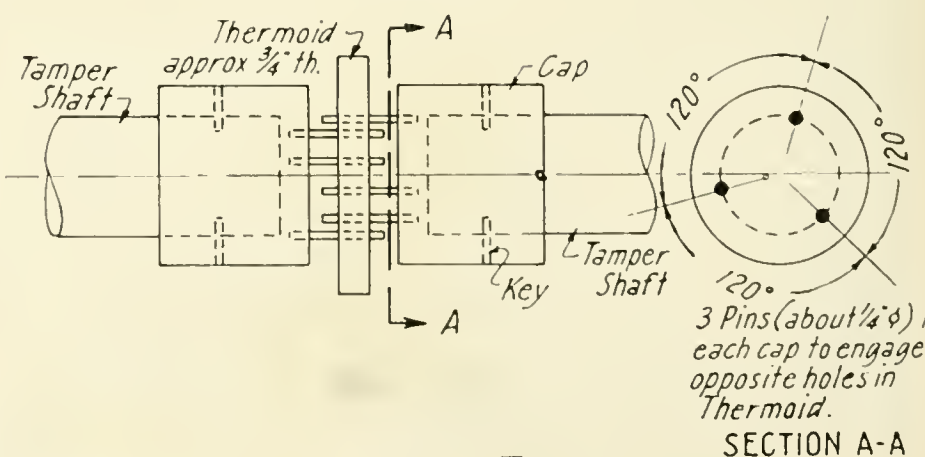


Figure I

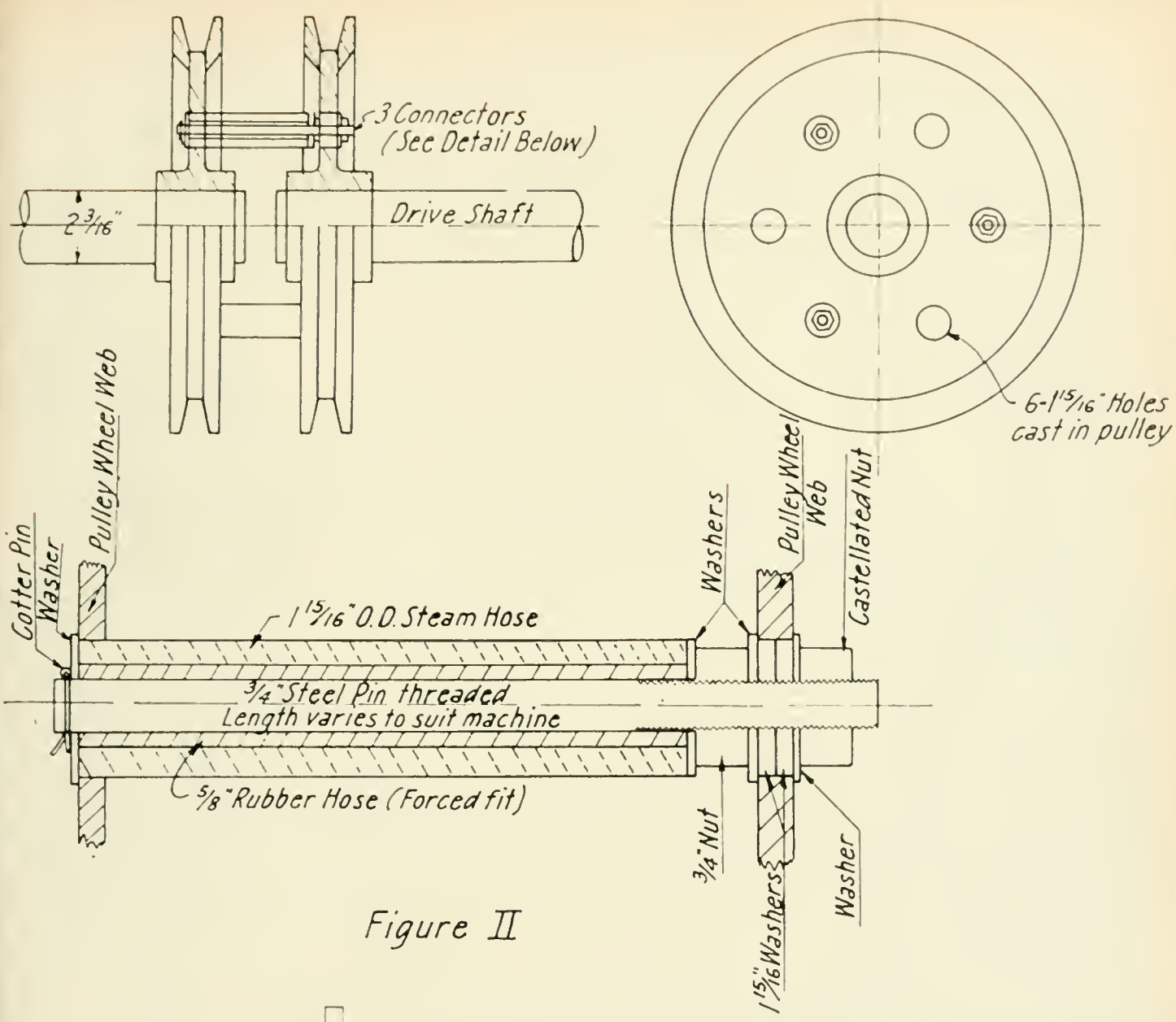


Figure II

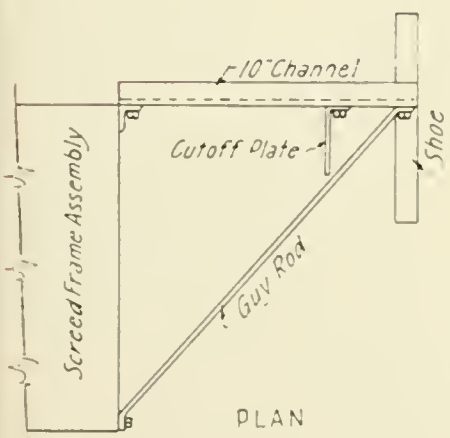


Figure III

The existing shoulder is usually irregular in cross fall, and, rather than have widely varying depths at the outer edge of the taper, a shaper was constructed to follow the undulations of the existing shoulder. This consists of a 3-foot length of 10-inch channel section fastened to the screed with one bolt through the lower corner, which acts as a hinge. The outer end riding on a shoe 2 feet in length is connected with the screed frame assembly by means of a rod that permits the unrestricted rise and fall of the shaper with the changes in cross fall of the existing shoulder. The cutoff shoe on the machine proper is entirely removed, and a cutoff plate is bolted to the 10-inch channel section at the desired width to be spread. This device is illustrated in **Figure III.**

DESIGN CHANGES NECESSARY

It is believed that these devices are the best so far developed and are recommended for general use throughout the State.

The foregoing changes are suggested as temporary corrective measures for machines already in service. It is our belief that the manufacturers of this equipment are the ones to make the necessary changes in the design of the machines to overcome the objections raised and the necessary steps are being taken in this regard.

The work in District IV was conducted under the supervision of District Engineer Jno. H. Skeggs and District Construction Engineer R. P. Duffy.

Right of Way Problems on Freeways

(Continued from page 4)



streets were checked. The investigation included the study of over 125 typical cul-de-sac street situations in the metropolitan area of Los Angeles. We are selecting more than 200 cul-de-sac street locations containing all types of building improvements such as office buildings, industrial plants, single family residences, hotels, apartments and retail stores for further study—it having been our conclusion that this group of locations represented typical real estate conditions wherever found. The length, width and type of improvement of the street was also taken into consideration.

It is our opinion at this time that the damage, if any, to individual properties depends to a great extent on the depth of the dead-end street. In other words, the distance of the individual properties in the cul-de-sac from the next intersecting cross-street.

We took into consideration the high nervous tension existing in the modern cities generally, which is primarily created by heavy traffic volume; the fact that a reasonable proportion of the population is constantly seeking out greater quiet, and less traffic confusion in the vicinity of its place of abode; and that the sacrifice of certain conveniences and advantages of a through street as compared to a cul-de-sac are, in the minds of these people, is more than offset by the substantial advantages of the quiet, seclusion and safety features of residences on cul-de-sac streets.

DEDUCTIONS

We naturally deduce from these findings that there is a ready market for residential properties on the cul-de-sac streets.

A hotel or apartment house abutting upon a cul-de-sac loses the advertising value it would have located on a through street. It also must be conceded that any type of commercial enterprise is probably more difficult for the average person to find than if it were located on a well-known through street.

It therefore must be determined whether this loss of advertising value and certain difficulty of location is offset by the increased safety to pedestrian patronage because of less and slower traffic, the definite safety advantages to prospective tenants having children, and the increased quiet and privacy.

There is a definite damage to retail mercantile establishments because of their being located on a newly created cul-de-sac street. The kind of damage and the monetary value thereof requires careful analysis and study of each individual case.

It has been found that certain types of office buildings, for example, those housing the headquarters office or the district office of organizations operating on a State-wide or Nation-wide basis, find certain distinct advantages on the cul-de-sac street as compared to a through street, particularly a heavily traveled arterial. Advantages of the location are the elimination of annoyance of through traffic to employees because of noise, fumes and dust. The natural result of the elimination of these factors tends to minimize the nervous tension of employees, with resulting increase in production.

TYPICAL EXAMPLES

Some typical examples of this situation are the district office of the Union Oil Company and the Home Office of the Metropolitan Life Insurance Company, both in San Francisco. On the other hand, there are definite disadvantages to the location of an office building containing upper floor retail shops, offices of professional men, etc., all of which create a heavy flow of traffic to and from the building, unless the entrance of such a building would be located not more than 50 to 100 feet into the cul-de-sac. In the study of industrial properties, we found numerous manufacturers both large and small, who purposely located on cul-de-sac streets because of the advantages of getting away from the annoyance and delays caused by through traffic passing in front of their plant and also because of the increased safety factor to the employees.

On the other hand, we found an equal number of operators of manufacturing plants who would not under any circumstances locate their factories upon cul-de-sac streets.

Our conclusion is that there is sufficient demand for industrial properties on cul-de-sac streets to create a reasonable demand which should offset to a great extent the damage, if any.

We are entirely satisfied that the many advantages to the owner and occupant of single family and multiple dwelling improvement located on cul-de-sac streets more than make up for the disadvantages and inconveniences, and that when the cul-de-sac is not over a maximum of five lots deep, even the property located in the sac itself has a fair market value comparable to a similar residential development on a through street. This conclusion is based upon the assumption that the highest and best use of both properties is for residential purposes.

Photograph No. 3 showing Serrano Place south from Lemon Grove Avenue in Los Angeles, and **Photograph No. 4**, Los Arboles Lane in San Marino, are typical examples of the type of development that is found upon cul-de-sac streets, both examples represent improvements comparable in every way to the improvements located upon adjoining through streets.

In our study of the numerous examples previously referred to in this article, we have not taken into consideration the several adverse decisions of the Supreme Court of the State of California—the cases of *People* vs. *Ricciardi*, *Bacich* vs. *State Board of Control*, *Beals* vs. *Department of Water and Power*, and others—in reaching our conclusions, for the reason that our studies have been made for the purpose of determining the actual effect upon the various types of properties, and whether the properties were actually enhanced or depreciated in value, regardless of the legal aspect of each situation.



CALIFORNIA MISSIONS

(Continued from page 13)

sidio was completed. Greatly saddened, Fr. Serra returned to Monterey. He had blessed a site for a military post and not for one of his beloved missions. In postponing the start of Mission Santa Barbara Governor Neve acted in direct opposition to the wishes of the Viceroy of Mexico.

The presidio builders found the Indians, known as Yanonalits after their chief of that name, extremely friendly. The natives willingly helped to build the post and the numerous barracks, dwellings and other buildings required.

Fr. Serra made his last visit to Santa Barbara in November, 1783, on a farewell trip to all the missions to administer the holy Sacrament of Confirmation. He performed this service in the chapel of the presidio. Governor Neve was recalled to Mexico and only a month before his death at Monterey, Fr. Serra received from Governor Pedro Fages the glad tidings that Mission Santa Barbara was at last to be established.

Due to the interference of Neve, the College of San Fernando in Mexico had refused to send more missionaries to California, but on April 1, 1786, Fr. Presidente Fermin Lasuen, who had succeeded Fr. Serra, was notified that six padres were being assigned to Monterey for duty. In October of that year, Fr. Lasuen arrived at Santa Barbara from Monterey with Fr. Cristobal Oramas and Fr. Antonio Paterna of Mission San Luis Obispo.



Fountain in garden of Mission Santa Barbara

BUILDING BEGAN

While Fr. Lasuen raised and blessed a cross on the site selected on December 4, 1786, formal founding of this, the tenth, mission did not take place until December 16th, following the arrival of Governor Fages. Fr. Lasuen then returned to Monterey leaving Fathers Paterna and Oramas. Early in the next year the work of building the mission began, the two priests meanwhile living at the presidio, a mile distant.

The story of Mission Santa Barbara, "Queen of the Missions," is so inextricably woven into the history of the Santa Barbara presidio and early California that it is difficult to relate it without going into voluminous detail involving much historical data. Hence what follows is but the essence of the tale.

Records faithfully kept by the resident padres at Santa Barbara during the "Mission Period" and thereafter tell of the extensive building operations that characterized activities at the station from its inception. During 1789 a new church was erected. In 1793 a more imposing edifice was started, the third church to be built, and was dedicated March 19th, the following year. With extensions, it served until 1812, when it was partially demolished by the earthquake of that year. It, in turn, was replaced by the existing structure of stone. During this construction era many other mission buildings were completed. In 1797 the padres received the Fourteen Stations of the Cross which adorn the nave of the present mission church.

REBUILT AFTER EARTHQUAKE

The imposing church built after the earthquake was begun in 1815 and finished in 1820. In this connection, Father Engelhardt asserts that each successive church was constructed around the one it replaced and that the three places of worship dedicated in 1789, 1794 and 1820 all occupied the same site.

The Indian community at Santa Barbara increased steadily and adobe habitations for each family were provided. The neophytes were given food and clothing and taught trades and agricultural pursuits. The Indian rancherias controlled by the mission-

aries prospered. In 1806 a reservoir of masonry was built and today is evidence of the skill and patience of the padres. The fountain that may be seen at Santa Barbara was constructed in 1808.

Fr. Vicente de Sarria, Commissary Prefect of the Missions, recorded on November 5, 1817, that the Indians of the channel islands were coming to the mission to be baptized and many of them were remaining there.

UNREST AMONG INDIANS

An uprising of Indians, who were growing more resentful under military oppression, occurred at Mission Santa Ines on the afternoon of February 21, 1824, and spread to Santa Barbara. The trouble was precipitated by the flogging at Santa Ines of a neophyte of Purisima Mission. In spite of efforts by Fr. Antonio Ripoll, resident missionary, to calm the Santa Barbara Indians several clashes between the neophytes and the presidio soldiers took place, three of the latter were wounded and two natives were killed. The Indians fled to the mountains and Captain Jose de la Guerra, presidio commandante, dispatched a force after them. A skirmish ensued in which four Indians were killed. Later, Fr. Ripoll and Fr. Sarria accompanied an expedition into the mountains and persuaded the frightened fugitives to return to the mission, but not before four defenseless natives had been slain by soldiers on the mission grounds and the adobe homes of the neophytes looted.

In December, 1827, the Mexican governor ordered the expulsion from California of all Spaniards under 60 years of age, except those who had married Mexican women. Father Ripoll and Fr. Altimira of San Buenaventura were subject to the ban and without waiting to be ejected fled from the country on January 23, 1828. Fr. Ripoll was succeeded by Fr. Juan Moreno.

MISSIONS CONFISCATED

Mission Santa Barbara witnessed a skirmish between government forces and a band of revolters led by Joaquin Solis, who started an unsuccessful insurrection at Monterey in November, 1829. This incident was important to the missionaries for out of it grew the unfair banishment of Fr. Luis Martinez of Mission San Luis Obispo, who was accused by Governor Echeandia of aiding the rebels.

On July 15, 1833, Governor Jose Figueroa issued his decree emancipating the mission Indians, a year later ordered secularization of the missions and on November 4, 1834, completed his confiscation of the Franciscan stations. At this time, Santa Barbara mission owned 3,400 head of cattle, 2,624 sheep, 25 goats, 55 pigs, 340 horses and 70 mules.

Mission Santa Barbara was turned over to Jose Garcia, civil administrator, on July 25, 1835. An inventory showed the mission and property to be valued at $113,960, less debts amounting to $1,000. The padres and their Indian wards now were dependent upon the politicos for food, housing and clothing.

Governor Figueroa died September 29, 1835, expressing the wish that he be buried in the church of Santa Barbara Mission. The funeral was held at Monterey and Figueroa's body taken to Santa Barbara in the brigantine Avon. As no record of burial was entered in the mission Death Register it was not until August 24, 1911, when the church vaults were opened and the remains of Figueroa identified that the mystery surrounding his final resting place was cleared up.

Mariano Chico was appointed to succeed Figueroa. He was overbearing and unfriendly. Arriving at Santa Barbara on June 14, 1836, he claimed that he had been received with scant courtesy by the fathers of Mission Santa Ines and because Fr. Duran asserted no disrespect had been intended, Chico returned to Monterey and ordered Fr. Duran expelled from California. On the day the padre was to take ship from Santa Barbara, the people of that pueblo arose en masse and prevented the priest's expulsion. Six days later, Chico was recalled to Mexico.

CALIFORNIA'S FIRST BISHOP

Father Duran's long, brave fight to protect his "children," as he called the mission Indians, has been dealt with at length by all mission historians. He welcomed the arrival on January 11, 1842, of the Very Rev. Francisco Garcia Diego y Moreno, who had been appointed by Pope Gregory XVI as the first Bishop of the newly created Diocese of California.

Following the successful revolt against Governor Micheltorena, who had restored the California missions to the church, Pio Pico took charge of the

(Continued on page 32)

Quarter Century Club of the Division of Highways Has 54 Members

There are now 54 members of the Quarter Century Club of the Division of Highways. Membership is composed of employees of the Division who have been in service for 25 years or more.

Officers of the club for 1945 are:

President, C. C. Carleton, Chief Attorney; First Vice President, George Hanson, Assistant Highway Engineer; Second Vice President, J. G. Standley, Principal Assistant Engineer; Secretary-Treasurer, C. H. Ryon, Chief Clerk Headquarters Shop; Historian, Thomas E. Stanton, Materials and Research Engineer.

During the year 1944, the following became members of the Club:

H. N. Houston, District VII. Mr. Houston is a Maintenance employee in District VII and first entered the service of the department on April 14, 1916. He became a member on April 18, 1944.

W. B. Cannon, Shop 7. Mr. Cannon is Superintendent of Equipment in District VII and first entered the service of the department on August 17, 1917. He became a member on May 10, 1944.

Fred R. Garrison, District III. Mr. Garrison is a Maintenance Superintendent in District III and first entered the service on August 19, 1919. He became a member on August 19, 1944.

J. H. Skeggs, District Engineer in District IV. Mr. Skeggs first entered the service on August 25, 1919. He became a member on October 31, 1944.

Howard F. Briggs, District VI. Mr. Briggs is an Associate Highway Engineer in District VI and first entered the service on May 9, 1919. He became a member on November 14, 1944.

The purpose of the organization has been purely social—a get together organization where members available can meet occasionally and reminisce concerning interesting events in State highway history.

President Carleton requests that any employees of the Division of Highways who are eligible send in application for membership.

In Memoriam

Robert Max Shobe, Jr.

ROBERT MAX SHOBE, JR., Assistant Highway Engineer in the Department of Public Works, Division of Highways, District VI, Fresno, succumbed to pneumonia following an operation. He passed away on January 6, 1945, in the St. Josephs Hospital in San Francisco.

Mr. Shobe was born in Umphreys, Missouri, June 21, 1917, and was reared in Visalia, California, where he attended grammar and high school and the Visalia Junior College.

Between 1937 and 1941, he was employed by Tulare County and later by the City of Visalia in engineering work. In December, 1941, he accepted a position in the District XI office as a delineator, subsequently qualifying as an Assistant Highway Engineer, in which capacity he transferred to District VI last February.

While working in District XI, Mr. Shobe enlisted in the Navy and was granted a leave of absence in October, 1942. After several months in the Navy he was given a medical discharge and returned to work in District XI.

He is survived by his wife and parents.

Former Highway Man Turns Inventor at a Belgium Bomber Base

A NINTH AIR FORCE FIGHTER BOMBER BASE, BELGIUM: Master Sergeant Claude L. Williams, 26 years old, Rio Vista, California, armament section chief in the "Thunder Bums" fighter squadron, has rigged up a bomb loading device which enables one man to load a 1,000-pound bomb on a P-47 Thunderbolt in one minute.

Sgt. Williams is a former employee of the State Highway Department of California.

Previously, because of uneven terrain on which the planes are dispersed, four or five men were needed to lift the bomb by hand from the bomb cradle to hook it to the fixed bomb shackles under the wings of the airplane. The new device enables an armorer to adjust the 500- or 1,000-pound bomb to the shackle without help.

With the "adjustable-pitch" bomb loading cradle the armorers in the "Thunder Bums" squadron were able to load 12 Thunderbolts with bombs under each wing, as well as reload all the .50 calibre machine guns, in 35 minutes, a procedure which previously took them at least an hour.

CALIFORNIA MISSIONS

(Continued from page 31)

government and Santa Barbara Mission was doomed.

On April 30, 1846, Bishop Diego died and two months later, June 10th, Pico sold Mission Santa Barbara to Richard S. Den for $7,500. Five weeks after the passing of Bishop Diego, good Fr. Duran went to his reward.

American occupation came in July and records of the mission tell of visits by Commodore R. F. Stockton, Colonel John C. Fremont and others who followed the Stars and Stripes. On May 31, 1850, the Very Rev. Joseph Sadoe Alemany, Provincial of the Dominicans, was named by the Pope to be first Bishop of Monterey with jurisdiction over all of California. It was Bishop Alemany who obtained consent from Rome for the founding of an ecclesiastical college at Santa Barbara and formally bestowed the mission upon the Franciscans for that purpose in April, 1853. And it was Bishop Alemany who waged the long fight in the United States courts to recover the California missions. President Lincoln formally returned Santa Barbara mission to the church on March 18, 1865.

In July, 1856, the church and convent erected by the Franciscans in the city of Santa Barbara was ceded to the College of the Propagation of the Faith of the Friars Minor and the Franciscan monks retired to the old mission, and by grace of the Pope their school there since has been known as the College of Our Lady of Sorrows. Unlike the other missions, Santa Barbara never was deserted by the Franciscans, the mission candles never have ceased burning since the day of its founding. The mission was damaged by an earthquake in 1925, but was restored. Its great wealth of old church treasures and relics and its sheer beauty must be seen to be appreciated.

CORRECTION

Instructions to motorists desiring to visit San Gabriel Mission from Los Angeles, which appeared in connection with the article on this mission in the last issue of California Highways and Public Works, should have read "* * * out North Broadway to Huntington Drive keeping on the right side of Huntington Drive to the community of Alhambra. Turn right at Main Street and continue to the east city limits of Alhambra, turning right at Mission Road, and proceed two blocks to the mission."

Mission motorists leaving Mission San Buenaventura at Ventura take the Coast Highway, El Camino Real (U. S. 101), through the charming Carpinteria Valley, the city of Carpinteria, Summerland and Montecito, famed the world over for its beautiful estates, and come into Santa Barbara. The mission is located at Garden, Los Olivos and Laguna streets and is 14 blocks from the business center. Busses leaving the downtown district every 20 minutes stop at the mission.

Motoring from the north the route is over the Coast Highway, U. S. 101, direct from San Francisco to Santa Barbara, or through the San Joaquin Valley to Bakersfield, thence west to Taft and Maricopa, then south over the new Ventura-Maricopa Highway to Ojai, west 17 miles to Carpinteria and north 12 miles to Santa Barbara.

Next—Mission Santa Ines and Mission La Purisima Concepcion.

In Memoriam

Fred C. Weigel

On January 8, 1945, Fred C. Weigel, Associate Highway Engineer in District V, succumbed to a brain tumor following a brief illness. He was 45 years of age.

"Fred" was born in Cleveland, Ohio, in 1899 receiving his high school education in Tucson, Arizona, and college education at the University of Arizona.

His early engineering activities carried him into the copper mines around Globe and Miami, Arizona. He later worked for the Southern Pacific Railroad of Mexico and left that position to engage in private work in Santa Barbara, California. He came to work for the Division of Highways in District V in November, 1927, first serving as a rodman on a survey party. Through successive years he advanced to Associate Highway Engineer in 1941 in which capacity he served until his death. In recent years he was Resident Engineer on many contracts in District V and during the most recent months served on design in the District Office.

His untimely death is deeply felt by his co-workers in District V and other associations made in the progress of his work. He is survived by his wife Leota, his mother Mrs. Gussie Weigel, and his sister Mrs. Margaret White of Bellflower, California.

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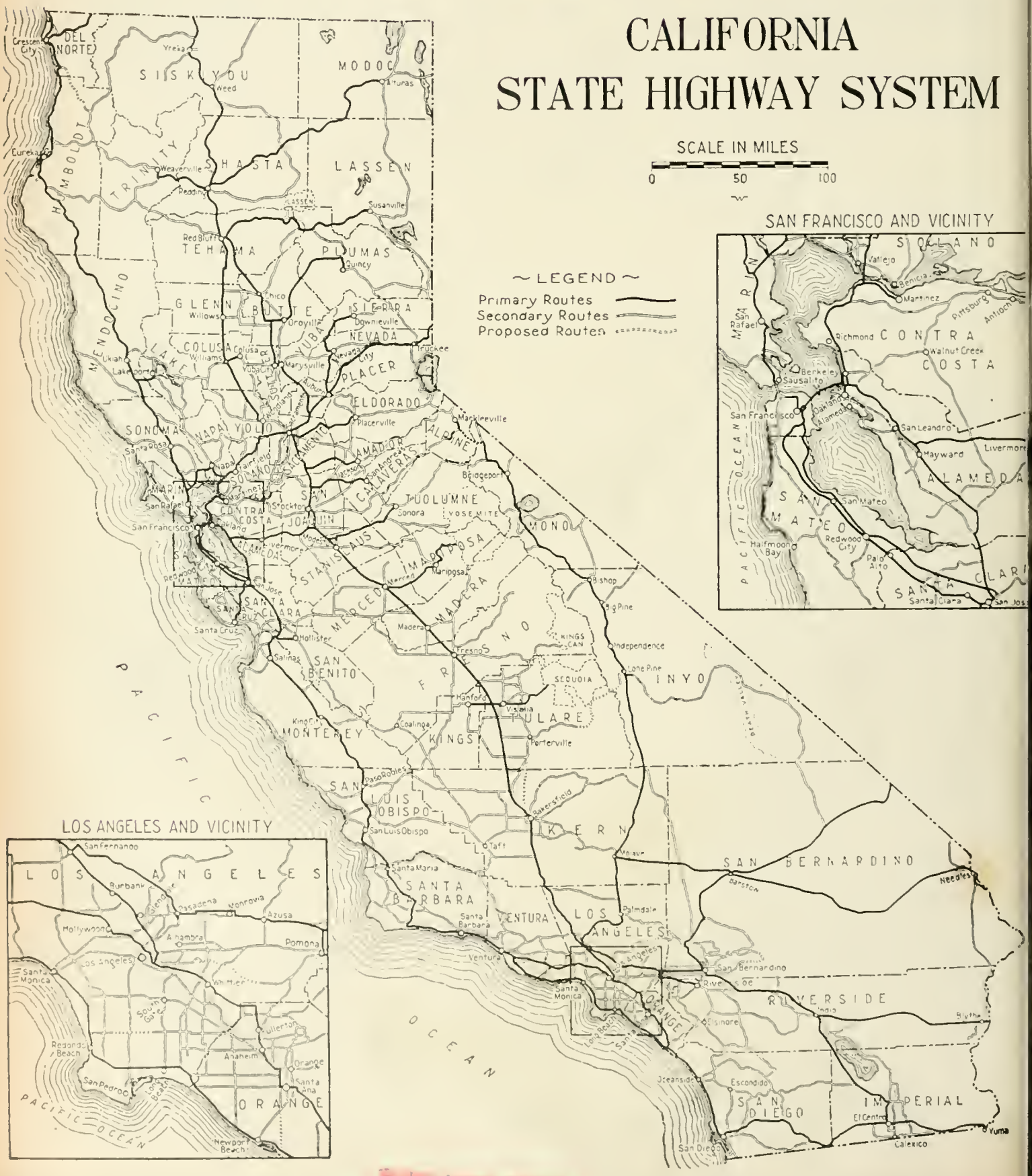
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CALIFORNIA STATE HIGHWAY SYSTEM



CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



MAY-JUNE
1945

1945

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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New Traffic Counting Procedure for Commercial Vehicles Inaugurated

By CHARLES V. GAY, Associate Statistician

FOR a number of years the Division of Highways has been concerned with the weight of commercial trucks and combinations. This interest has not been confined to those relatively few vehicles which exceed legal limitations as to total weight or weight on a specific axle, but has been extended to all commercial vehicles, large and small, which constitute the commercial burden imposed on the Highway System. The trend in frequency of occurrence of vehicles or combinations of vehicles of certain types, as well as the trend in the average gross weight of vehicles of each type, has a direct bearing on the loads imposed upon the highway and consequently upon the proper highway design required to support these loads.

In 1936 the Highway Planning Survey undertook a program of truck weighing on a regular schedule for a period of one year. Under this program weights were obtained for 151,593 commercial vehicles at seven pit-scales and at 90 loadometer stations well distributed over the Highway System to produce representative coverage. With this large amount of data available, no further weighings were made until the fall of 1942, at which time a limited program was undertaken at ten representative locations all of which coincided with locations weighed in original 1936 survey.



Equalizing beam and loadometers in place in concrete loadometer pit

This limited survey was repeated in the fall of 1943 and again in the fall of 1944 with the coverage increased to 19 locations. In addition to weights obtained for 5,022 commercial vehicles on the rural highways in the past three years, the scale facilities of San Francisco-Oakland Bay Bridge and Carquinez Bridge were utilized to obtain weights on some 11,000 vehicles between December, 1944, and March, 1945.

Comparison of the 1944 weighings with those obtained in 1936 indicates an increase in the average weight of all trucks and combinations from 11,556 to 19,281 pounds, or 66.8 per cent as shown in Table I.

The large increase in the weights of commercial vehicles between 1936 and 1944 was due in part to the relatively greater proportion of heavier type vehicles with multiple axles using the highways and in part to generally heavier loadings, particularly with respect to vehicles which formerly operated empty or lightly loaded in one direction, but which, as a result of increased activities due to the war and pressure on transportation facilities, were able to operate loaded for a greater proportion of their total mileage.

TABLE I

Comparison of Average Weight of Trucks, 1944 vs 1936

Vehicle Classification	Year Weighed 1944	1936	Per cent increase over the period
Empty trucks and combinations	9,372	7,225	34.7%
Loaded trucks and combinations	23,470	13,779	70.3
All trucks and combinations	19,281	11,556	66.8
Average maximum axle load of loaded trucks and combinations	11,995	6,622	81.1

STABILITY OF WEIGHTS

Careful analysis of the weights of commercial vehicles from the foregoing sources, when broken down by vehicle type, indicates that for any given type the average weight of all vehicles encountered on the highway, including fully loaded, partially loaded, and empty vehicles of the type, tends to become stabilized within a comparatively small sample and, further, that this stabilized average weight will generally hold within a reasonably small range irrespective of the geographic location of the vehicles. Vehicle types are classified on the basis of axle arrangement. Thus, a two-axle truck is classified as Type 2, a two-axle truck pulling a two-axle trailer is classified as Type 2-2, and a two-axle tractor-truck pulling a two-axle semi-trailer is classified as Type 2s2, etc. A type 2s2 pulling a three-axle trailer is classified as Type 2s2-3.

This relative stability of average weights is brought out by the data in Table II, which shows the average weights of several of the more frequently encountered vehicle types as obtained from loadometer weighings made at widely scattered locations over the State and from the Carquinez and San Francisco-Oakland Bay Bridge weighings.

GROUP AVERAGE

The comparison of the average weight of all vehicle types supported by the same number of axles irrespective of the arrangement of the axles is shown in Table III. It will be noted that while certain types within a group may vary considerably from the group average, they are, as a rule, types which are seldom encountered and thus have but slight effect on the group average. In fact, each group average is largely controlled by one or possibly two predominant vehicle types. Thus, in the group supported by three axles, the average weight of Type 2-1 vehicles is but approximately half of the group average. However, this type of vehicle represents but 0.40 per cent of all commercial vehicles weighed and the group is dominated by Type 3 and Type 2s1 vehicles, which represent 11.33 per cent of all commercial vehicles weighed.

A study of the data presented in Table III leads to the conclusion that it would be possible to determine the average and total weight of commercial vehicles passing over a specific highway location with a reasonable degree of accuracy by merely making a traffic count of such vehicles, classified according to the number of supporting axles, and converting this count to total weight of traffic for the period counted by expanding the number of vehicles in each classification by the average weight applicable thereto. The average weights used as expansion factors would, of course, be revised from time to time as the results of actual weighings indicate changes in vehicle design and loading practices.

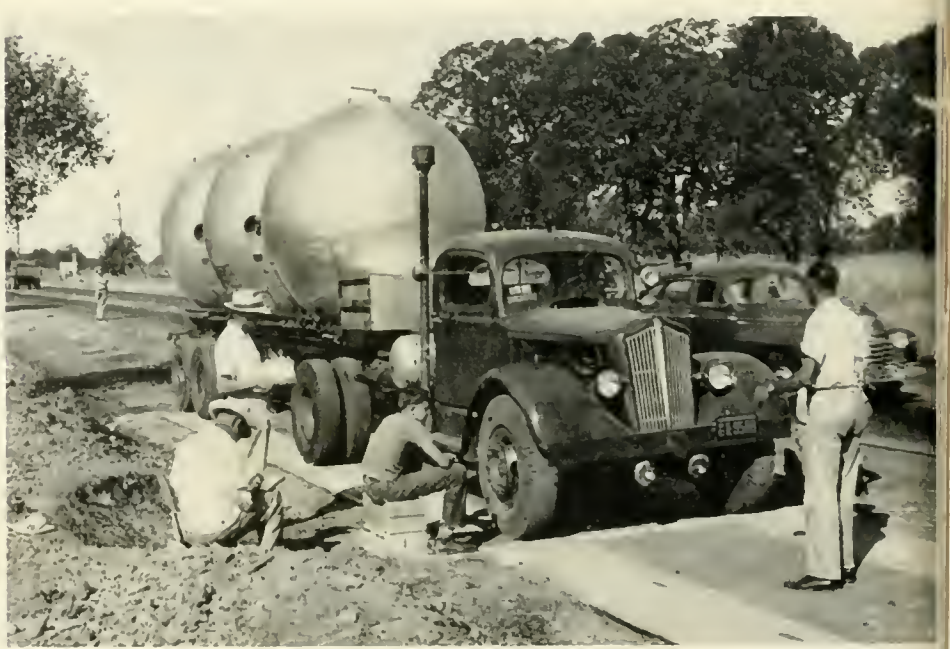


Weighing third axle of type 2s2 gasoline transport combination

PROCEDURE REVISED

It has been our practice for a number of years to classify commercial vehicles as light trucks, heavy trucks, and trailers. Under this procedure there was no clear-cut line of demarcation between what constituted a light truck or a heavy truck, this being left to the judgment of each enumerator. Further, trailers were counted separately from the trucks which pulled them, but semitrailers were not counted at all, being included in the heavy

Weighing first axle of type 2s2 butane gas transport combination



ruck classification. This treatment lid not readily lend itself to conversion o a weight basis. Consequently, our raffic counting procedure is being re-ised by eliminating certain vehicle lassifications and substituting there-or a classification based on the num-ber of supporting axles, as follows:

Classifications Eliminated
- Light trucks
- Heavy trucks
- Truck trailers
- Trailer coaches
- Other passenger car trailers

New Classifications
- Pickups
- Two-axle trucks
- Three-axle trucks
- Four-axle trucks
- Five-axle trucks
- Six-or-more-axle trucks

In order to keep the number of traf-ic classifications within practicable imits it was necessary to eliminate the Trailer Coach and Other Passenger Car Trailer classification. However, hese vehicle types have not attained he importance in the traffic picture hat their use at one time indicated night occur and it is believed the loss of this information will be more than offset by the gain to be obtained through the use of the new truck classifications. It will be noted that a new classification, Pickups, has been added to the commercial grouping. This classification has been provided to cover light commercial vehicles weighing not over 3,000 pounds when unladen and licensed as passenger cars. Such vehicles have not been included in our weighing activities and consequently are not reflected in the average weight of two-axle trucks.

Grant P. Merrill Honored

ASSOCIATED with highway promotion, construction and maintenance for 35 years, Mr. Grant P. Merrill, Highway Maintenance Superintendent of District IX, has resigned. He has been employed by the Division of Highways since August 15, 1912 and was highway maintenance superintendent at Mojave since September 1, 1933, transferring there from District X.

On the evening of May 29, associates and friends of Mr. Merrill gathered at Reno's Cafe in Mojave to tender Mr. Merrill and Mrs. Merrill a testimonial dinner. Highway Foreman M. M. Warner was master of ceremonies. The affair was attended by District Engineer S. W. Lowden of District IX and his staff.

TABLE II

Average Weight of Certain Types of Commercial Vehicles as Obtained From Various Sources

Source of Data	Type 2 Number Weighed	Type 2 Average Weight	Type 2s1 Number Weighed	Type 2s1 Average Weight	Type 3 Number Weighed	Type 3 Average Weight	Type 3-3 Number Weighed	Type 3-3 Average Weight
1942-3-4 Loadometer Surveys	2,710	9,842	236	21,960	235	21,233	442	50,893
1944-5 Carquinez Bridge	2,063	8,775	208	24,212	226	20,140	518	51,014
1944-5 S.F.-Oakland Bridge	5,233	9,056	602	21,843	369	20,744	141	45,778
All Sources	10,006	9,216	1,046	22,361	830	20,715	1,101	50,295

TABLE III

Frequency Distribution and Average Weight of Commercial Vehicles Classified by Number of Supporting Axles

Type of Vehicle	Number Weighed	Per cent of Total	Average Weight Pounds
Two-axle Vehicles			
2	10,006	60.41	9,216
Three-axle Vehicles			
2-1	67	.40	11,113
2s1	1,046	6.32	22,361
3	830	5.01	20,715
Group Total	1,943	11.73	21,281
Four-axle Vehicles			
2-2	192	1.16	28,364
2s1-1	2	.01	44,600
2s2	1,516	9.15	30,670
3-1	5	.03	33,920
3s1	21	.13	29,347
Group Total	1,736	10.48	30,424
Five-axle Vehicles			
2-3	51	.31	38,327
2s1-2	253	1.53	45,846
2s2-1	5	.03	44,840
2s3	7	.04	36,686
3-2	206	1.24	40,726
3s2	958	5.79	44,515
Group Total	1,480	8.94	43,966
Six-or-more-axle Vehicles			
2s1-3	20	.12	54,450
2s2-2	133	.80	43,163
3-3	1,101	6.65	50,295
3s1-2	9	.05	55,910
3s2-1	3	.02	58,333
3s3	113	.68	50,769
2s2-3	12	.07	43,950
2s3-2	1	.01	38,900
3s2-2	5	.03	60,120
3s2-3	1	.01	58,300
Group Total	1,398	8.44	49,745
Total	16,563	100.00	19,377

Bridge Maintenance Practice On California Highway System

By R. J. ISRAEL, Associate Bridge Engineer

THERE are 4,636 bridges on the California State Highway System omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is $12,500,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenanceand Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the fourth. It deals with Repair of Steel Trusses.

STEEL truss bridges comprise in number only 4.5 per cent of all structures on the California State Highway System, exeluding the State-owned toll bridges. However, numbers alone do not indicate the relative importance of the steel trusses since the great majority of the long spanned structures, and most of the movable bridges on the system, are of this type. The roadway area of the steel truss bridges, including only the steel truss portion of composite structures and not including approach spans of other types, comprises 11 per cent of the total bridge area. The value of the steel truss structures represents approximately 20 per cent of the total value of all State Highway bridges.

Steel structures, when properly maintained, show virtually no deterioration with time. Due to this cause and to the fact that structures of this type are generally costly to replace, the elimination of the old and inadequate steel trusses has not kept pace with the replacement of obsolete structures of other types. This condition is best demonstrated by the fact that 29 per cent of all State Highway bridges which are posted for less than legal loads are steel truss structures. The above figures show that in spite of the relatively small number of such bridges, steel trusses represent a sizable maintenance problem.

Maintenance and repair as it applies to steel structures may be divided in three classes as follows:

1. Normal and continued maintenance as necessary to preserve the structure.
2. Repair of accidental damage.
3. Strengthening, and improving clearances.

NORMAL MAINTENANCE

By far the heaviest and most costly maintenanee item on steel truss bridges is painting. In the coastal regions of the State particularly, steel structures must be painted at frequent intervals in order to prevent actual reduction in area of members due to corrosion. Structures directly adjacent to the ocean should be eleaned and repainted every four or five years, while for those structures located some miles inland, sueh as the Redwood Highway or the easterly shores of San Francisco Bay, the painting interval will be 7 to 10 years. On the other hand, in the Central Valleys and other dry areas of the State, the painting of steel is primarily for appearanee. In these areas steel trusses may be allowed to go unpainted for a great number of years without measurable loss of metal.

Another important item of constant maintenance is the clearing of earth, leaves, and other debris from trusses and truss shoes. In forested areas particularly, leaves will accumulate in the truss joints and within the boxed lower chords of riveted trusses. If allowed to remain they retain moisture, thus hastening the deterioration of the paint covering and, in time, causing pitting or corrosion of the steel. The accumulation of debris around the expansion rollers on the truss piers not only causes rust and corrosion but the heavier materials may aetually jam or otherwise iuterfere with the action of rockers or roller nests.

REPAIR OF DAMAGE

Damage to truss bridges of the through and pony truss type is caused primarily by highway traffic. More speeifically, overheight or overhanging loads, and improper or eareless operation of vehicles are responsible for sueh damage in the majority of eases. Floods cause considerable damage to bridges of all types, both through underscour of the foundations, and through the impact of heavy objects carried by the flood waters. The lower chords and bracing of deck

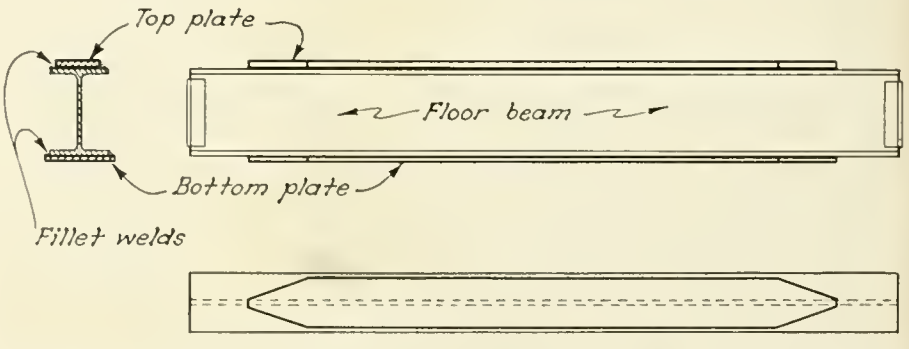
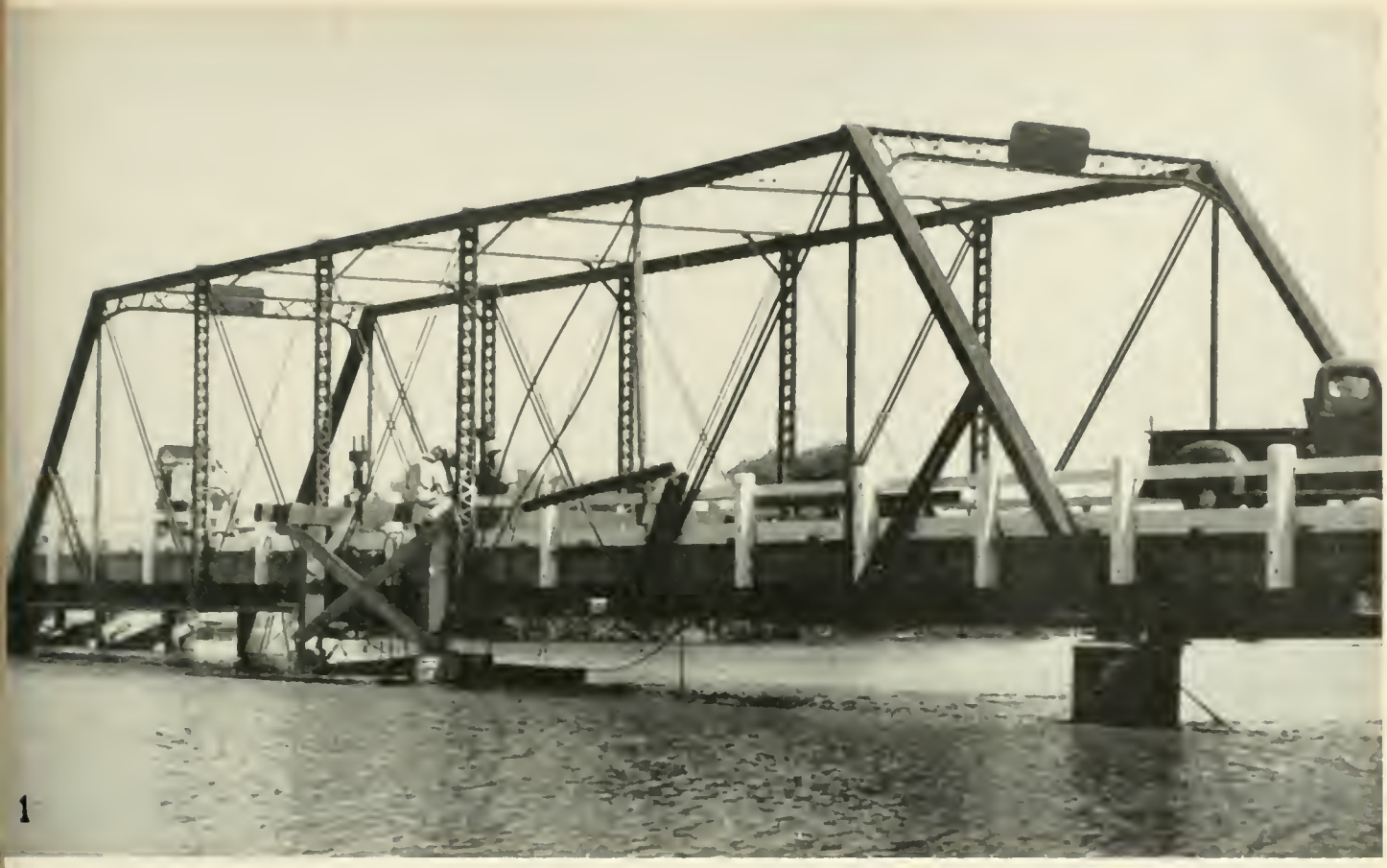


PLATE METHOD OF STRENGTHENING FLOOR BEAMS



Repair of traffic damage at Kings Slough Bridge. Truss has been jacked back to grade through C. M. P. caissons and temporary supports placed under top chord. The broken vertical posts, bent almost double, shown in the center foreground

trusses are particularly susceptible to this latter type of injury in those locations where clearances are insufficient under flood conditions. Fire has been a minor cause of damage to steel trusses since bridge steel is of low carbon content and not readily damaged by heating.

In the past decade five steel trusses and two combination steel and timber trusses have been so severely damaged by highway loads as to cause complete collapse of the structure. In each such instance trusses were of the pin-connected type, generally of light design, and lacking adequate lateral bracing. In every case structure and structural members were so badly racked, bent or broken that restoration of the truss was not economically feasible.

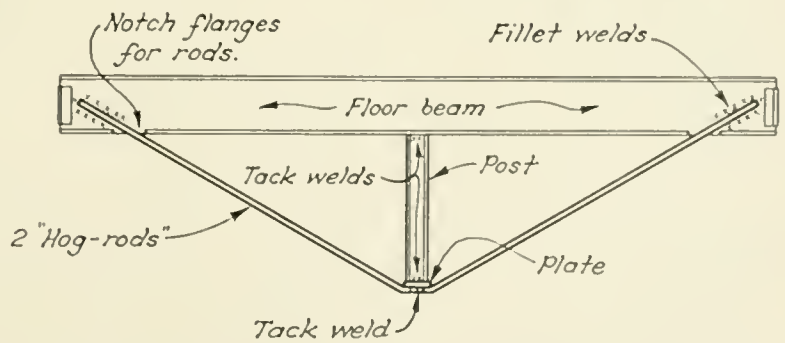
EXAMPLES OF BRIDGE DAMAGE

On the other hand, a great number of truss bridges have been struck and vital members broken or otherwise rendered ineffective without causing failure of the truss. Riveted type structures, due to stiffer lateral bracing and more rigid connections, have in every instance proved able to survive such damage. More difficult to explain is the fact that a number of pin-connected trusses, old and of light design, have remained standing even though primary members were either broken or otherwise rendered virtually incapable of supporting load.

A light steel truss of 154 feet span, built by San Luis Obispo County in 1910 is in this latter class. A runaway trailer crashed into and wedged between the two end posts at the south end of the structure, partially fracturing and badly bending both of these primary compression members without causing failure of the span. Repairs consisted of temporarily bolting supporting timbers to the two damaged posts and later placing falsework under the three adjacent panel points and replacing the posts in kind.

KING'S SLOUGH BRIDGE

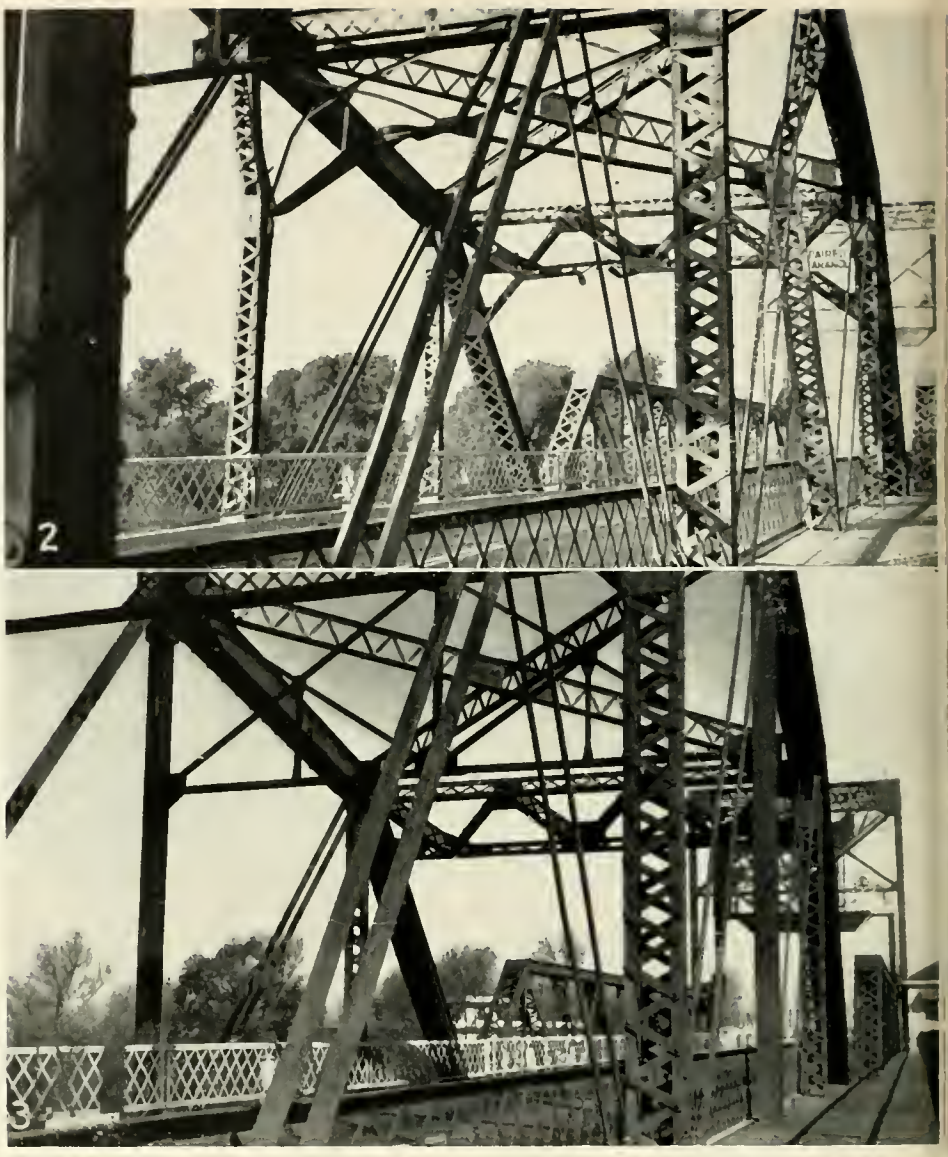
The main span of the King's Slough Bridge on State Route 41 consists of a 120-foot through truss, originally con-



TRUSS BEAM METHOD OF STRENGTHENING FLOOR BEAMS

structed in 1896. This is an extremely light, pin-connected structure, probably of wrought iron, and posted for restricted loading. A weaving trailer hooked into and completely severed the vertical post of the northerly truss at the second panel point, causing severe twisting of the adjacent floorbeam, damage to the top chord joint and to lateral members, and considerable warping of the trusses. The structure not only sustained itself in this condition but two trucks and several automobiles crossed the bridge before barricades could be placed.

In order to restore the structure to proper grade, two caissons were constructed by welding steel plates to one end of 24-inch x 20-foot long corrugated metal pipes. These caissons which were sunk in 18 feet of water and filled with concrete were placed outside and adjacent to the third and fourth panel points of the north truss. Timber beams, one end supported on the caissons and the other on the curb of the sound southerly truss, were placed to support the jacks. Jacking was accomplished through a yoke between the floor beams adjacent to the damaged truss and U-bolts which extended through the deck. The broken vertical member was replaced with a 12-inch I-beam, prefabricated to fit existing connections. The twisted floorbeam was straightened and tears in floor beam web and at connections were repaired by field welding. **Photo No. 1** shows this structure after it had been jacked back to grade and the upper chord strutted, but before the broken vertical was replaced.



Before and after pictures of traffic damage repair on the Mossdale Bridge. Figure 3 shows the damaged posts replaced with H beams

REPAIR METHODS

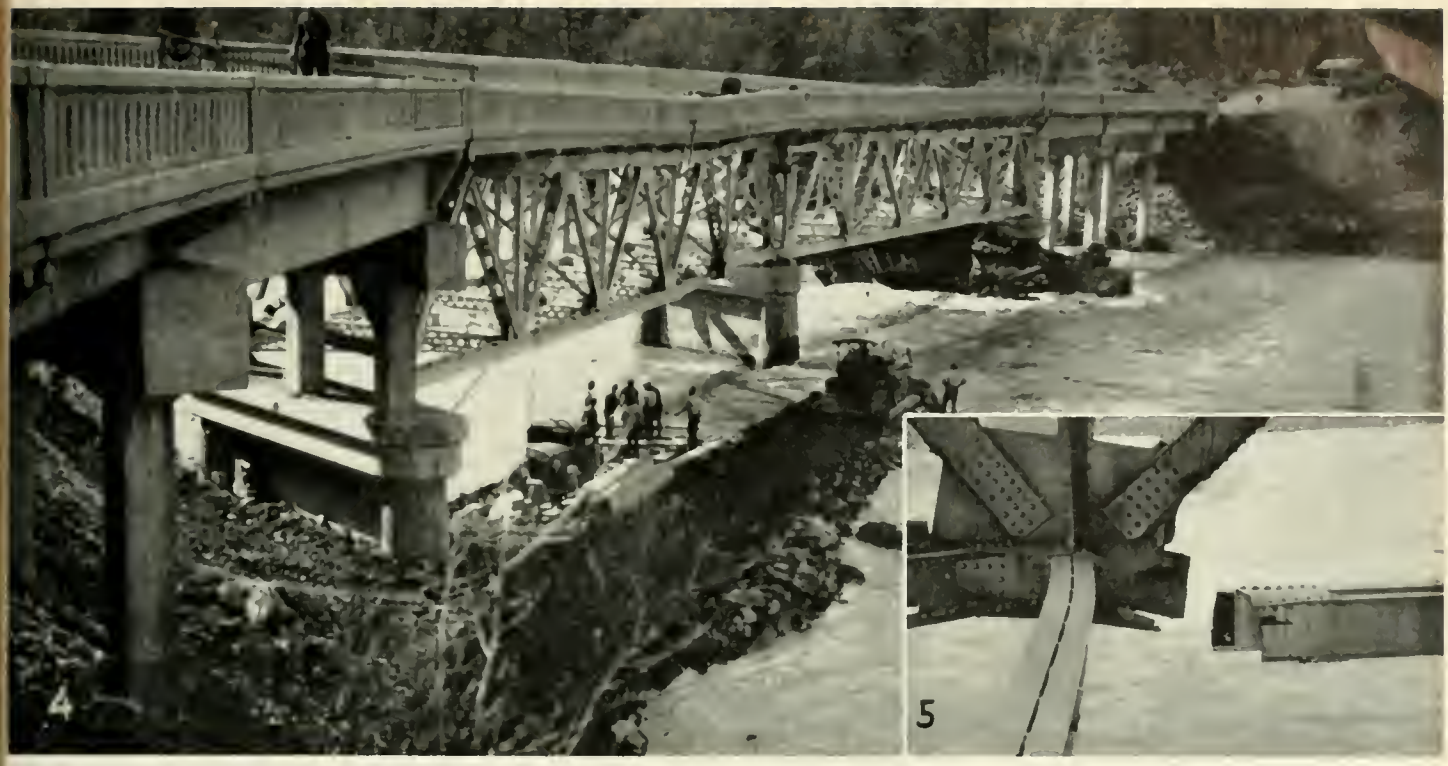
Normally, when a truss is seriously damaged as above, the first step in repair is to place temporary supports under the adjacent panel points to relieve the weakened member and generally reduce stresses throughout the truss. Occasionally the height of the truss or poor foundation conditions make sure method of support impracticable, as at the Mossdale Bridge over the San Joaquin River. Here a load of illegal height struck the east portal frame, severing two steel angles, and continued through to strike the first intermediate sway frame.

All members of this frame were bent and twisted out of shape and the two adjacent major compression members of the truss were pulled and twisted out of position some two feet inward and nine inches in the direction of traffic. Although this 200-foot truss span could no longer act as designed, it continued to carry all traffic for some time before the condition was reported. In this case the temporary supports were steel H-beams jacked between the truss chords alongside the damaged posts. The repair consisted of replacing the damaged posts with 10-inch H-beams, the use of rolled beams rather than an attempt to match the laced channel compression members being standard procedure. However, in this case, instead of trying to fit existing connections at the chords, the damaged posts were merely cut away between the end batten plates, the stubs capped with steel plates, and lengths of H-beam welded between. The damaged sway frames were replaced with new members welded into place. The damaged truss and the completed repair are shown respectively in **Photos 2 and 3.**

TRINITY RIVER BRIDGE

Probably the most spectacular instance of damage to trusses from floating objects occurred at the Trinity River Bridge on Route 20 in the winter of 1940. A dredger barge, torn loose from its moorings by the flood waters, was first driven against the lower chord of the southerly truss span and then forced around against the adjacent northerly truss.

The upstream lower chord of the south truss was completely severed and both lower chords were bowed out of line. A majority of the lower lateral struts in both trusses were broken, and a great number of main and bracing



The damaged Trinity River Bridge with temporary repairs under way. Inset shows the severed lower chord

members, and gusset plate connections, were badly bent and twisted. These were riveted deck trusses of modern design, 125 feet span, and the stiffness of the joints, coupled with the remaining lateral stability of the unbroken bracing were sufficient to prevent complete failure. The south truss was temporarily supported on timber cribs and a contract was let to replace the worst damaged members, and to straighten those that could be salvaged. **Photo No. 4** shows the damaged structure with temporary repairs under way and **Photo No. 5** is a closeup of the severed chord.

A vehicle will often hook onto the inside bar of a tension diagonal, leaving a permanent bend in the member and causing the other bar to take all the stress. A method which has been used extensively for straightening plates in the shipbuilding industry has been used recently to successfully correct this condition. This method consists of applying controlled fast heat to a short, V-shaped segment of the bar. As this short section expands it is compressed between the colder adjacent portions of the member, local upsetting occurs and is maintained by rapid quenching. This method is repeated at several points along the convex side of the bend until the bar is straightened. A "come-along" attached to the bar and applying pressure in the required direction aids the process. Although a bar thus straightened will, of course, be unstressed under dead load, it is able to assume its share in supporting live load.

STRENGTHENING

There are a great number of lightly designed steel trusses on California highways, the majority of which were inherited by the State through extensions of the Highway System. Due to the relatively high cost of steel truss replacements, the elimination from the system of all inadequate structures of this type will require many years. For this reason the strengthening and improving of existing steel trusses is of primary importance in eliminating undue restrictions to traffic.

The deck system on the older trusses is often inadequate for present day highway loads, and such members have been strengthened in a great number of bridges, particularly when trusses themselves proved adequate. Additional stringers may be added, between existing lines, to bring stringer capacity up to legal requirements, or, where the deficiency is small, a higher

Floor beams of a through truss bridge strengthened by the truss beam method



type floor may provide the proper strengthening by better distributing the wheel loads to existing stringers.

Floorbeams are, in most instances, the critical member from the standpoint of load capacity, and extensive work has been done in the strengthening of floorbeams on the lighter trusses. The most common method is to increase the capacity of the existing beam by welding steel plates to the top and bottom flanges. This work can be most easily accomplished in conjunction with replacement of the deck system, since dead load is thus removed and the top flange is made accessible. A variation of the method, when deck is not replaced, is to weld two bars to the under side of the upper flange in place of the single plate on top. Installation is more difficult and costs necessarily higher under this latter method.

TRUSSED BEAM METHOD

The trussed beam method of strengthening floorbeams is often used where clearances and drift conditions permit. This method consists in converting the floorbeam into an inverted king post truss by means of a vertical post and one or more bent steel rods, commonly known as "hog-rods." Generally, under this method, dead load is supported by beam action and live load is taken by the truss. However, where conditions permit jacking from below, the dead load stress in the beam may be relieved before the rods are welded into place. The two primary methods of strengthening floorbeams are illustrated in this article and **Photo No. 6** shows the use of the trussed beam method to reinforce floorbeams on a steel truss span.

Where a few truss members reduce the capacity of the structure far below that of the balance of the truss, such members can be replaced or reinforced. However, when a large percentage of truss members are below standard, such methods are seldom economically feasible, as such structures are usually also inadequate in width, lateral stability and other features.

The 90-foot riveted, deck truss over the Mad River on Route 35 in Trinity County proved an exception. Although the structure was of light design, it was otherwise adequate for the small amount of traffic on this secondary highway. In this instance, the truss span was shortened one panel at each end by placing inclined bents to supports at the base of existing abutments. In addition, a number of truss members were strengthened by welding additional angles or rods to these members and reinforcing the existing riveted joints with fillet welds.



Improvement of vertical clearance by replacement of main trunion braces on the Petaluma Creek Bridge

MOVING TRUSSES

Although under normal conditions the moving and re-erecting of a salvaged steel truss is not economically justified, the present shortages in structural materials have necessitated such procedure in a few instances. Where a light truss is thus reused, the shortening of the span by eliminating one or two center panels will increase the capacity of virtually all truss members and generally add to rigidity and lateral stability.

Truss bridges as a general rule are very difficult to widen. On through and pony truss structures, the spacing between the trusses is the limiting factor as truss capacity is generally insufficient to warrant complete replacement of lateral members. Capacity to support the increased live and dead loads is generally the limiting factor in deck trusses. However, roadway widths are often effectively increased by other means. Where pedestrian

(Continued on page 23)

Report on Progress and Records in Pavement Construction During 1944

By EARL WITHYCOMBE, Assistant Construction Engineer

DURING the year 1944, out of a total of about 600 miles of highway construction, but 35.2 miles of high type pavement, portland cement and asphalt concrete, were constructed, this being the second lowest mileage during the past twenty-year period. During the war emergency, high type pavements have been held to the absolute minimum, since these types require a maximum of manpower and equipment.

In conformance with current Federal regulations, no reconstruction of existing highways was done, other than essential access projects which were sponsored by the Federal Government, and for which the State acted as the construction agency. About 159.2 miles of such access roads were constructed during the year, 26.5 miles being high type pavements, and 132.7 miles low type bituminous surfaces.

Highways improved with State funds were practically all surfaced with bituminous blankets applied to existing pavements which had deteriorated due to heavy traffic during the war emergency. A total of 439.4 miles of such repair surfacing was done, about 3.4 per cent of the entire rural State Highway System. It is doubtful if the State System can continue to serve traffic requirements satisfactorily for very long under such a limited improvement program. The necessity of reconstruction and replacement is fast approaching the critical stage.

The quality of work obtained under this greatly curtailed program was somewhat inferior to that of prewar pavement construction; however, it maintained the average quality of all work done since the start of the war.

Portland Cement Concrete

The limited pavement program of 1944 was constructed with the same general design as was adopted in 1942 for war work. Based on the results of experimental paving sections constructed in many of the older jobs, a radical departure from prewar design is now being planned for postwar construction.

An extensive study is at present in progress under the supervision of the Materials and Research Department, covering existing portland cement concrete pavements, with the object of gathering information on the influence of mixture design and subgrade characteristics in relation to the performance of concrete pavements. It is hoped that facts uncovered in this survey may be of material value in improving the design of future pavements.

The highest **average daily output** of portland cement concrete during 1944 was made by J. A. Casson Co. & N. M. Ball Sons, on Contract 10AWC1, road X-Sol.-Nap.-74-B, A, B, North City limits, Vallejo to Suscol Creek, where an average of 609.1 cu. yds. per 8-hour day was placed. G. R. Hubbard was resident engineer, with E. Carlstad as street assistant. The average daily output for the entire State was 425.8 cu. yds. in 1944, compared to 354.9 cu. yds. in 1943.

The highest **average compressive strength** during 1944 was made on Contract 11AXC1, road XI-S.D-199-A, Palm Avenue to the Silver Strand, with 4221 pounds per square inch. Griffith Company was the contractor; H. F. Caton, resident engineer; and

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1944

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per day	Average strength, 28 days, lbs. per sq. inch	Roughness index, inches per mile
At Hunter's Point, Donahue St., Jerrold and Kirkwood Avenues	Eaton & Smith	C. T. Ledden	E. W. Strandberg	83.0	4016	27.3
Sequoyah Road, Oak Knoll Blvd.-San Leandro Naval Hospital	Heafey-Moore Co.	L. G. Marshall	L. G. Marshall	119.4	3462	22.1
At Atlantic and Bandini Blvds.	Vido Kovacerich	R. M. Cooley	R. M. Cooley	117.4	3552	7.5
Douglas St., Imperial Highway-1400 ft. South	Olympic Contracting Co.	G. H. Lamb	G. H. Lamb	236.1	3535	11.3
Sepulveda Blvd.-Valjean Ave.	Griffith Company	C. P. Montgomery	V. O. Sheff	293.0	4190	16.0
N. City Limits Vallejo-Suscol Creek	J. A. Casson Co. & N. M. Ball Sons	G. R. Hubbard	E. Carlstad	609.1	4030	9.5
Third Street, Napa-Suscol Creek	J. A. Casson Co. & N. M. Ball Sons	G. R. Hubbard	E. Carlstad	485.9	3470	8.5
Palm Avenue-The Silver Strand	Griffith Company	H. F. Caton	G. L. Richardson	373.5	4221	10.3
Mission Valley Road-Linda Vista Housing Project	Griffith Company	R. C. Payne	B. F. Moore	227.7	2968	9.5
			Averages	425.8	3876	10.3



Portland cement concrete pavement north of Vallejo on new 8.9 mile access road project

G. L. Richardson, street assistant. The average strength of 28-day breaks for the State was 3876 pounds, compared to 3570 pounds for 1943.

The record for **riding qualities** was made on Contract 7AXC2, VII-L.A-167-A, at Atlantic and Bandini Boulevards, with an average roughness index of 7.4 inches per mile. Vido Kovacevich was the contractor; R. M. Cooley, resident engineer and street inspector. The average for the State in 1944 was 10.1 inches, compared to 14.2 inches in 1943.

Asphalt Concrete

All of the work constructed this year was laid with the type of spreader machine that operates without the

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1944

Location	Contractor	Resident Engineer	Street Assistant	Average tons laid per day	Average stability of surf. mix in %	Roughness index, inches per mile
Hunter's Point Blvd., Innes Ave., Donahue Street	Fay Improvement Co.	G. L. Beckwith	J. H. Creed	168.5	42.0	16.8
0.3 mi. S. of San Leandro-N. City Limit of San Leandro	Lee J. Immel	F. W. Montell	G. W. Levier	491.4	37.6	18.0
Barrett Ave.-Pennsylvania Ave.	Macco Construction Co.	W. A. Rice	D. N. Sapp	272.1	41.0	44.4
Waldo-Golden Gate Bridge	A. G. Raisch	H. A. Simard	C. Hendrickson	373.0	44.0	15.0
San Francisco-Oakland Bay Bridge-Toll Plaza	Lowrie Paving Co.	H. A. Simard	C. Hendrickson	421.9	41.5	14.0
Gilman Street Intersection and Approaches	Lee J. Immel	F. W. Montell	W. Z. Hegy	322.7	47.0	13.0
Ala. C. C. County Line-San Pablo Ave.	A. J. Raisch	H. A. Simard	J. H. Creed	525.9	32.8	10.6
Broadway Tunnel-Orinda Junction	Union Paving Co.	G. L. Beckwith	W. Z. Hegy	375.3	48.0	13.8
Burbank, Buena Vista St.-N. City Limits	Oswald Bros.	C. P. Montgomery	V. O. Sheff	713.8	45.0	14.4
Southern Pacific Railroad-Sherman Way	Griffith Co.	C. P. Montgomery	T. C. Peterson	354.5	43.0	21.6
Third Street, Napa-Suscol Creek (por.)	J. A. Casson Co. & N. M. Ball Sons	G. R. Hubbard	G. R. Barry	534.4	38.0	16.7
Vallejo Township Bus Routes, Project No. 2	Lee J. Immel	G. R. Hubbard	G. R. Barry	490.0	43.0	23.9
Vallejo Township Bus Routes, Project No. 1	Piazza & Huntley	G. R. Hubbard	G. R. Hubbard	485.4	42.0	19.1
S. City Limits Coronado-Naval Air Station	V. R. Dennis Construction Co.	W. T. Rhodes	S. M. Templeton	216.5	49.6	25.0
			Averages	392.0	42.8	18.2

use of side forms. The operation of laying the pavement was broken up into as many courses as was commensurate with the maximum size of aggregate being used. This procedure was followed in order to obtain as much benefit as possible from the repeated leveling action of the machine with each spreading operation.

The grade of asphalt most commonly used was the 85-100 penetration. Plans are being made for the use of considerable 60-70 penetration asphalt in the 1945 program.

The highest **average daily output** of asphalt concrete during 1944 was on Contract 7VCS, V11-L.A-4-Brb, Burbank, Buena Vista St. to North City Limits, where an average of 713.8 tons per 8-hour day was laid by Oswald Bros. C. P. Montgomery was resident engineer, with V. O. Sheff, street assistant. The average daily output for the State was 392.0 tons, compared to 495.7 tons in 1943.

The highest **stability** of surface mixture was obtained on Contract 11ASC4, X1-S.D-Cord, South City limits Coronado to Naval Air Station, with an average of 19.6 per cent. V. R. Dennis Co., contractors, also made the best record in 1943. W. T. Rhodes was resident engineer, and S. M. Templeton, street assistant. The average for the State was 42.8 per cent compared to 43.3 per cent in 1943.

The record for **surface smoothness** was secured on Contract 4WMC3, IV-C.C-69-Reh., E. Cr., Ala.-C.C. County Line to San Pablo Avenue, with an average roughness index of 10.6 inches per mile. A. J. Raiseh was the contractor; H. A. Simard, resident engineer; and J. H. Creed, street assistant. The average for the State was 18.2 inches, compared to 17.4 inches in 1943.

Bituminous Treated Surfaces

Plant-Mixed

The plant-mixed method of construction was used on 71 per cent of the bituminous treated mileage laid in 1944, and 95 per cent of this surfacing was laid with spreading machines.

A considerable mileage of open graded mixture was laid in 1944. The leveling courses under these surfaces were both dense graded and open graded; the dense graded being used over foundations that were permeable and in which the infiltration of water would cause failure. Open graded surfaces and leveling courses consist of crushed stone with practically all of the fines below the No. 16 sieve removed. The maximum size of aggregate in the leveling course does not generally exceed ¾-inch, and in the surface course, it does not exceed ½-inch. To this aggregate is added paving asphalt ranging from 150 to 300 penetration in amount practically the same as is used in dense graded mixtures. The film thickness of the asphalt cover on the aggregate of open graded mixes is considerably greater than that of dense graded, and, in order to maintain this heavy coverage,

(Continued on page 26)

This photograph shows a section of 70-foot asphalt concrete pavement near Redwood City



BITUMINOUS TREATED SURFACES—RECORDS FOR 1944

PLANT-MIX

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
Rattlesnake Summit-Garberville	Clements & Co.	E. F. Richardson	17.9
N. Scotia Bridge-Fortuna	Mercer, Fraser Co.	C. M. Butts	23.3
Route 85-Blue Lake	Mercer, Fraser Co.	J. E. Dessinger	12.3
Morgan Summit-Plumas County Line	Lester L. Rice	F. S. Saunders	11.2
3 miles E. of Paynes Creek-Mineral	Mercer, Fraser Co.	P. F. Duffy	16.0
2.7 miles N.E. of Rush Creek-Chambers Ranch	McGillivray Construction Co.	C. I. Brown	11.7
4 miles S.W. of Adin-2.7 miles N.E. of Rush Creek	E. B. Bishop	C. I. Brown	10.1
Route 87-Oroville Airport	Lester L. Rice	A. C. Irish	17.5
Various sections on Routes 3, 11, 50, Sacramento, Placerville, Yolo Counties	McGillivray Construction Co.	H. A. Towne	18.9
Route 17-U. S. Hospital, N. of Auburn	A. Teichert & Co.	A. C. Irish	38.5
Bretona-Genevra	Clements & Co.	H. A. Towne	14.7
Nelson-1.2 miles N. of Durham	Piazza & Huntley	E. L. Miller	18.8
McConnell Station-Sacramento	A. Teichert & Co.	H. A. Towne	13.0
Biggs Road-Oroville Wye	Piazza & Huntley	E. L. Miller	10.7
Four sections, Routes 3 and 87 Sutter and Yuba Counties	Lester L. Rice	F. D. Hillebrand	7.4
Three sections of road IV-C.C,-75-B,D	Lee J. Immel	P. F. Green	12.6
Willow Pass-Dublin	A. J. Raisch	W. G. Remington	15.4
Napa-Yountville	E. A. Forde	W. A. Rice	11.0
Vallejo-Napa (por.)	E. A. Forde	W. A. Rice	11.7
San Rafael Viaduct-Calif. Park Overhead Bridge	A. G. Raisch	W. A. Rice	29.7
El Cerrito Hill Overhead-Richmond	Lee J. Immel	F. W. Montell	14.4
Dublin-Castro Hill	W. C. Railing	G. L. Beckwith	22.6
San Joaquin County Line-1 mile W. of Mountain House	A. A. Tieslau & Son	W. G. Remington	20.8
Petaluma-San Rafael	A. G. Raisch	W. A. Rice	17.0
Junction Route 106-2.5 miles E. of Antioch	A. J. Raisch	W. G. Remington	14.6
Santa Cruz-Davenport	A. J. Raisch	A. Walsh	27.3
Sequoyah Road, Oak Knoll Blvd.-San Leandro Naval Hospital	Heafey-Moore Co.	L. G. Marshall	21.0
Cebada Canyon-Buellton	Griffith Company	J. C. Adams	27.1
San Luis Obispo County, three sections on Routes 2 and 33	Granite Construction Co.	G. H. Hamlin	13.6
Gaviota Creek-Arroyo Grande (por.)	Brown, Doko & Baun	M. Chapman	19.2
0.8 mi. W. of Pennington Creek-Morro Bay	Brown, Doko & Baun	V. E. Pearson	27.9
Madera-Merced County Line	M. J. Ruddy & Son	R. Windele	15.1
5.1 miles N. of Kern County Line-0.5 mi. S. of Pixley	Brown, Doko & Baun	P. A. Boulton	11.2
Goshen Underpass-3 miles northerly	Brown, Doko & Baun	P. A. Boulton	17.3
Oil King School-Heron Road, Hub-4.6 miles northerly	Brown, Doko & Baun	P. A. Boulton	27.4
Maricopa-Route 4, 0.5 mi.-6.5 mis. E. of Kern River	Griffith Company	J. W. Cole	25.2
2 miles W. of Waco-4.7 miles W. of Famosa	Griffith Company	J. W. Cole	15.4
Monrovia-La Verne (por.)	Pacific Rock & Gravel Co.	H. B. Lindley	14.7
Colorado St.-0.1 mi. S. of San Gabriel River	Owl Truck & Construction Co.	H. B. Lindley	17.7
Solamint-Acton Road, Saugus-Route 23	Schroeder & Co.	H. E. Belford	11.5
San Diego County Line-Doheny Park	Sully-Miller Contracting Co.	H. B. Lindley	19.2
On Vanowen St. and Clybourne Ave. (por.)	Warren Southwest Inc.	C. P. Montgomery	20.1
Trabuco Road, Rte. 2-Marine Base, Central Ave., Rte. 2-Trabuco Road	W. E. Hall Co.	C. L. Gildersleeve	20.4
Figueroa St., Anaheim St.-B St., C St., Hawaiian Ave.-Figueroa St.	Griffith Company	W. D. Eaton	16.1
Ontario St., Woodley Ave., Roscoe Blvd.	Schroeder & Co.	H. E. Belford	21.4
Avenida Dolores, San Clemente, Rte. 2-S. D. Co. Line	Sully-Miller Contracting Co.	W. D. Eaton	16.0
Figueroa St., Adobe St.-Riverside Drive	Vido Kovacevich	C. P. Montgomery	16.6
Lakewood and Rosemead Blvds. (por.)	Vido Kovacevich	W. D. Eaton	15.9
Oxnard-Camarillo	R. R. Hensler	V. O. Sheff	12.5
Routes 178 and 179 (por.)	Sully-Miller Contracting Co.	H. B. Lindley	19.5
Fillmore-Los Angeles County Line	Schroeder & Co.	E. L. Seitz	13.7
Etiwanda Ave., Mission Blvd., Valley Blvd.	Matich Bros.	B. Nelson	16.0
Waterman, Tippecanoe, and Cardiff Aves.	Lewis Construction Co.	E. A. Bannister	18.0
Arlington Ave., Van Buren St.-Magnolia Ave.	George Herz & Co.	J. M. Hollister	13.1
Newberry-Hector	George Herz & Co.	B. Nelson	11.3
Verdemont-Devore, Sycamore Ave.-Cajon Creek	George Herz & Co.	J. M. Hollister	17.0
At Windy Point, Route 26-Palm Springs	George Herz & Co.	J. M. Hollister	20.7
Tippecanoe Ave., 3d Street-Base Line Road	George Herz & Co.	E. A. Bannister	20.1
Vallejo Township Bus Routes, Project No. 3	Piazza & Huntley	G. R. Hubbard	15.6
Vallejo Township Bus Routes, Project No. 2	Lee J. Immel	G. R. Hubbard	17.2
Vallejo Township Bus Routes, Project No. 1	Piazza & Huntley	G. R. Hubbard	20.7
Hammond General Hospital	A. A. Tieslau & Son	F. Noel	11.9
Madera County Line-Merced	M. J. Ruddy & Son	E. L. Craun	13.2
West and East of Fairfield	Sheldon Oil Co.	G. R. Hubbard	11.8
Tracy-Grant Line Road	George French, Jr.	R. K. Wells	13.2
Holt-Stockton	George French, Jr.	R. K. Wells	10.6
San Joaquin County Line-Crow's Landing, and to Modesto	George French, Jr.	R. K. Wells	18.9
Newman-Los Banos	W. C. Railing	George Barry	17.9

BITUMINOUS TREATED SURFACES—RECORDS FOR 1944

PLANT-MIX—Continued

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
National City, Concrete Ship Construction Yard-National Ave.	V. R. Dennis Construction Co.	W. T. Rhodes	24.1
S. City Limits, Coronado-Naval Air Station	V. R. Dennis Construction Co.	W. T. Rhodes	25.0
Linda Vista Housing Project-San Diego River	Griffith Company	R. C. Payne	16.4
Escondido-North County Line, Oceanside-Route 77	Southwest Paving Co.	W. T. Rhodes	27.1
San Ysidro-Chula Vista	R. E. Hazard Co.	M. C. Barron	12.0
Mission Valley Road-Linda Vista Housing Project	Griffith Company	R. C. Payne	20.6
		Average	16.8

ROAD MIX

Knights Landing-Grimes	W. C. Railing	F. D. Hillebrand	74.1
1.0 mi. E. of Blackwell's Corner-Semitropic School	R. R. Hensler	W. B. Albertson	49.1
Mojave-Ricardo	Basich Bros.	W. I. Templeton	19.0
Antelope School-Route 58	Phoenix Construction Co.	R. F. Johnson	29.4
N. Reservation Gate-Muroc School	R. W. Hampton Co.	R. F. Johnson	38.2
Toyon-West Point	Claude C. Wood	E. L. Craun	29.9
Altaville-Murphy's	Louis Biasotti & Son	A. J. Hull	45.5
Route 65, Sutter Hill-Route 34, 1 mi. W. of Pine Grove	State forces	F. L. Lucas	28.4
1 mi. W. of Pine Grove-Cook's Station	State forces	F. L. Lucas	23.1
Camp Lockett-Route 200	B. G. Carroll	R. C. Payne	15.2
Route 12, Seeley-Camp Seeley	Arthur A. Johnson	F. B. Stewart	20.5
Dixieland-2 mis. E. of Seeley; El Centro-Meloland	Arthur A. Johnson	F. B. Stewart	21.2
Route 26-1.2 mis. South of Thermal	Basich Bros.	M. C. Barron	18.3
		Average	32.9

ARMOR COAT

Trinidad-Little Red Hen	Marshall S. Hanrahan	H. M. Hansen	21.3
0.4 mi. S. of Wilson Creek-Sapp Creek	Close Building Supply	R. A. Miller	42.3
Crescent City-Smith River Bridge	Marshall S. Hanrahan	H. O. Ragan	36.2
Near McClellan Field, E St., 16th-32d St.	A. Teichert & Co.	H. A. Towne	50.7
Belvedere R. R. Xing-Tiburon	A. G. Raisch	W. A. Rice	99.0
5.5 mis. E. of Gilroy-San Felipe	Piazza & Huntley	J. H. Creed	89.9
At Hunter's Point-Donahue St., Jerrold and Kirkwood Avenues	Eaton & Smith	C. T. Ledden	71.6
Seaside Junction-N. Reservation Boundary	M. J. Ruddy & Son	V. E. Pearson	46.7
San Ardo-King City	Granite Construction Co.	J. C. Adams	58.2
		Average	48.3

Plant-mix surface repair project north of Durham in Butte County



CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

Mission Santa Ines September 17, 1804

IN the year 1776, the Franciscan explorer, Fr. Hermenegildo Francisco Garces of Mission San Javier del Bac, Arizona, led an expedition into the interior of California and in Tulare Valley found a warlike tribe of Indians known as the Tulares. Here was a fertile missionary field, but because of the hostility of the natives and the desire of the Franciscans to complete their chain of missions in California no attempt to convert these savages was made for more than two decades.

Twenty-two years after the explorations of Fr. Garces, a military party was sent out from Santa Barbara by Father Fermin de Lasuen, Superior of the Missions, with instructions to locate a suitable site for a station between Mission Santa Barbara and Mission La Purisima Concepcion. With this force went Father Estevan Tapis.

Fate decreed that Fr. Tapis not only was to be the discoverer of the spot on which the new mission, Santa Ines, was to be located, but the founder as well. Four years later, on September 17, 1804, he raised the cross, blessed the water and site and established the nineteenth of the California missions on a rancheria called by the Indians Alajulapu and which today is located three miles east of Buellton in Santa Barbara County. Fr. Tapis then was Superior of the Missions, having succeeded Fr. Lasuen, who died before he, himself, could found the new station.

TULARES FIERCE TRIBE

Mission Santa Ines was placed in a valley between the Santa Ines and San Rafael mountains inhabited by Indian tribes that maintained intercourse with the fierce savages called the Tulares. It was the hope of Fr. Tapis that through mission converts he could carry Christianity to the pagans of the eastern Sierra.

Fr. Tapis baptized 27 children of natives the day he founded Santa Ines, which he dedicated to Virgin and Martyr, Saint Agnes. Fr. Tapis left Fathers Jose Antonio Calzada and Romualdo Gutierrez in charge. At the close of the year, Santa Ines had 112 Indian converts and at the beginning of 1806 its rolls carried a total of 570 neophytes, including 132 from Mission Santa Barbara and 145 from La Purisima Concepcion.

From 1804 to 1812 an extensive building program was carried on. The walls of the church, habitations for the padres, dwellings for the soldiers and their families, adobe homes for the Indian converts, warehouse, granaries and other structures were of adobe and about 30 inches thick. In the year 1812 more than 80 houses were built.

EARTHQUAKE DAMAGE

On December 21, 1812, much of the work of the padres was undone by an earthquake which rendered the church unserviceable and demolished the walls of many of the mission buildings. The following year a long structure was erected to serve as a church and it was not until 1817 that the new church, the ruins of which stand restored today, was completed. It was dedicated July 4, 1817. Its interior was modeled after the Santa Barbara mission temple. Fr. Francisco Xavier Uria and Fr. Ulibarri continued building operations up to 1824 and obtained many beautiful vestments, furnishings and other church goods. When Fr. Uria took charge in 1808 there were 441 converts. His last baptism on February 17, 1824, was numbered 1227.

Beginning in 1810 when Mexico's revolt against Spain began, Mission Santa Ines, in common with the other missions, received no further aid from Mexico and was compelled not only to support itself but to provide food, clothing and money for the garrison at Santa Barbara. The Santa Ines Indians resented being compelled to work for the idle soldiers and this resentment flared into rebellion on February 21, 1824. As we have seen in the story of Mission Santa Barbara, the uprising extended to that station and to Mission Purisima Concepcion.

The Indians set fire to many buildings at Santa Ines, but when it appeared the flames would destroy the church their anger subsided and they helped save the edifice. All the workshops, soldiers' barracks and habitations of the guards were destroyed. The revolting natives fled to the Tulares, after causing great destruction

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into northern Washington.

Present day State highways lead to all the mission sites. When the war is ended and California again welcomes tourists from all over the world and there are no longer restrictions on automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways will publish in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions will be taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the fifth of the series.



Mission Santa Ines, restored to its former architectural beauty, as it looks today

at Santa Barbara and Purisima Concepcion. Several of them were killed.

In a letter to Don Lucas Alaman, Minister of Relations, in Mexico, the Fr. Guardian of the College of San Fernando de Mexico, sponsor of the Franciscan missions, wrote:

INDIANS COMPLAIN

"The revolt was not against the missionaries; on the contrary, the revolting Indians wanted to have the Fathers go along with them, and told them they would be cared for. * * * It may be said with truth that the missions alone, or the labor of the down-hearted neophytes, have sustained the troops since 1810. The Indians complain bitterly that they are toiling so that the soldiers may eat, and that they receive nothing for their labor."

During all the period from the revolt up to 1834, when Mission Santa Ines was fighting to survive under the oppression of a succession of civil administrations in California, the resident padres continued building. In August, 1834, all the missions were secularized but Santa Ines was not violently dealt with until 1836. In June of that year, the newly appointed Governor, Mariano Chico, en route from Monterey to Los Angeles, arrived unexpectedly at Santa Ines.

Fathers Jose and Antonio Jimeno had not been notified of the Governor's coming and were unprepared to receive him ceremoniously. Chico professed to be highly insulted and proceeded on to Santa Barbara, where he demanded of Fr. Presidente Duran that the two padres forthwith surrender the mission to Jose Maria Ramirez, civil commissioner. Because Fr. Duran defended his colleagues, he was ordered banished by the Governor, but, as related in the story of Santa Barbara, the people of Santa Barbara sided with the Fr. Presidente and prevented execution of the order.

DEPLORABLE CONDITIONS

Mission Santa Ines was turned over to Ramirez in July, 1836, and he placed it in charge of Jose M. Covarrubias, who was named administrator. The mission and property were valued at $56,437.62, less debts amounting to $5,475. A year later, Francisco Cota became administrator. When William Hartnell, inspector for the missions under Governor Alvarado, arrived at Santa Ines in May, 1839, he found conditions there deplorable.

Manuel Micheltorena came from Mexico to California as Governor on August 25, 1842, with instructions from the Mexican Government to return all missions to the Franciscans. On March 29, 1843, he carried out these orders in an official decree. And on March 16, 1844, Micheltorena, at the request of Father Jimeno and Juan Moreno of Santa Ines and Fr. Francisco Sanchez of the seminary at Santa Barbara, deeded to the padres land on which to erect a seminary college, granted them $500 a year for school maintenance and later gave additional land which placed a total of 35,499 acres under control of the college.

The plan for an ecclesiastical seminary was conceived by Bishop Francisco Garcia Diego y Moreno and on May 4, 1844, with the bishop and other church dignitaries present, the College of Our Lady de Refugio was founded. The happiness of the bishop and the fathers of Santa Ines was destroyed a year later when Pio Pico and his followers drove Micheltorena out of Cali-

fornia and Pico immediately schemed to confiscate the mission and its lands.

PICO ENEMY OF MISSIONS

"The principal object which guided me," Pico wrote in his Narracion Historica, "was to make the rule of the missions disappear completely."

Pico succeeded in doing just this. He first leased and then sold Santa Ines to Jose M. Covarrubias and Joaquin Carrillo for $7,000 on June 15, 1846. Three weeks later the American flag was raised at Monterey and Pico fled to Mexico, leaving the ruined California missions behind him.

Fr. J. J. Jimeno and Fr. Francisco Sanchez continued to conduct the college until May 7, 1850, when they turned the institution over to Rev. Theodosius Bousseier and Rev. Felix Migorel of the Congregation of the Sacred Hearts of Jesus and Mary. In 1868 the Franciscan Brothers took charge and in turn were succeeded by the Christian Brothers, who took over in 1877 at the request of Archbishop Alemany and served until 1882, when the school was closed and the college's 36,000 acres sold by Alemany for the diocese. The mission had been returned to the Catholic church on May 23, 1862, by President Lincoln.

One of the most interesting periods in the modern day history of Santa Ines began in November, 1882, when Fr. Michael Lynch, who had succeeded Fr. Juan Basso in 1875, invited Thomas James Donohue and his family of Gilroy, to come to the mission to live.

This is the chapel of Santa Ines Mission as the padres of old knew it



Donohue was a carpenter and stone mason and he and his sons made many needed repairs with the help of Fr. Lynch and Fr. Farrelly. Donohue's daughter Katharine, has written a most interesting account of the years they were at Santa Ines. She tells of Old Rafael, aged Indian, who devotedly took care of the church for many years and of Fernando Cardenas, known as Fernandito, who came from Ecuador as a boy and lived his life at Santa Ines, a beloved character. He died at Santa Barbara in 1919.

FATHER BUCKLER'S EFFORTS

In June, 1904, Fr. Alexander Buckler was appointed pastor of Mission Santa Ines and of Lompoc and Sisquoc and the surviving Indians. He was directed by Bishop Thomas James Conaty, D.D., of Los Angeles, to restore the mission buildings. He labored at this task faithfully until his death on March 7, 1930. He was assisted by his niece, Miss Mary Goulet, who came from Minnesota to aid him. She is the author of a priceless record of Father Buckler's heroic efforts to restore the old mission.

Mission Santa Ines is what it is today because of the work of Fr. Buckler and his niece, Bishop Conaty and the Native Sons of the Golden West. Also credit must be given to Fr. Buckler's "Dick Turpins," as he called them. They were tramps, hobos and wayfarers who happened by the mission over a period of years and were fed, housed and put to work on the mission by the padre.

Unprecedented rain storms in the spring of 1911 threatened complete destruction of Santa Ines, but Bishop Conaty and the Knights of Columbus of Los Angeles came to the rescue with funds and restoration was continued. The centenary of the mission church's dedication was celebrated on July 4, 1917.

Mission Santa Ines, at Solvang, lies 37½ miles north of Santa Barbara via scenic San Marcos Pass and the little town of Santa Ynez. This route traverses a delightful, undisturbed countryside. Another route to the Santa Ines Mission, which is about ten miles longer, is via the Coast Highway, skirting the ocean the greater part of the way. This scenic highway leads into historic Gaviota Pass, and over the hills through Las Cruces and Buellton by a newly constructed road, the magnificent engineering of which has eliminated grades and dangerous curves. Visi-

tors in Santa Barbara, having Mission Santa Ines and the northern part of Santa Barbara County as a goal, are advised to go one route and return the other. In this way they may derive the greatest pleasure from the scenic delights along both routes.

Motorists from the north may travel the Inland Route from San Francisco, State Highway No. 4, to Bakersfield, drive south 20 miles to State Highway 57, turn west to Maricopa and follow 57 to Santa Maria on the Coast Highway, proceeding thence south to Buellton and then three miles east to Mission Santa Ines. The other route from the north is over the Coast Highway No. 101, to Buellton.



This corridor vista charms visitors to Santa Ines Mission

La Purisima Concepcion December 8, 1787

ESTABLISHED on the day dedicated to the Singularly Most Pure Mystery of the Empress of the Heavens, Mary Most Holy, that is to say of her Immaculate Conception, as Fr. Guardian of the Missions Fermin de Lasuen, its founder recorded, Mission La Purisima Concepcion was foredoomed to tragedy.

Eleventh of the Franciscan Missions erected on El Camino Real, bringing nearer to reality the dream of Fr. Junipero Serra for a chain of missionary stations stretching from San Diego to San Francisco, Purisima Concepcion came into existence on December 8, 1787.

Its beginning delayed by the animosity of Governor Felipe de Neve, its first church and mission buildings totally destroyed by earthquake, long years of work by its faithful padres undone by an Indian revolt and its ruin finally accomplished by political intrigue, Purisima Concepcion of beautiful name furnishes a tragic chapter in the history of the old California missions.

In opposition to the expressed wishes of the Viceroy of Spain in Mexico, Governor Neve had succeeded in preventing the founding of Mission Santa Barbara and Purisima Concepcion for many years, but in August, 1786, Governor Pedro Fages communicated to Fr. Lasuen the welcome news that the Viceroy had ordered the establishment of a new mission on the Rio de Santa Rosa, now known as Santa Ynez River. And so Fr. Lasuen in a happy frame of mind set up the eleventh Franciscan station, ninth on the Road of the Padres from south to north.

BUILDING OPERATIONS BEGIN

Building operations began in the spring of 1788 and by the end of that year ninety-five baptisms had been solemnized and twenty-five marriages blessed. Records of activities at the mission up to 1794 are rather sketchy, but reveal that the Fathers steadily carried on with their construction work.

In December, 1798, Fathers Gregorio Fernandez and Antonion Calzada reported that "there are now 920 souls here, and the number, it is hoped, will be much greater with the favor of God."

The padres made great headway with the Indians and recorded that "paganism here has almost ceased." While no records are available, it is certain that the missionaries proceeded with the erection of a suitable edifice and with other building activities for in his biennial report 1800-1802, Fr. President Lasuen wrote:

"In the Missions of Purisima Concepcion and San Luis Rey they have in each one completed their church of adobe, sufficiently large and very becoming."

FEW RECORDS

"And that," says Fr. Zephyrin Engelhardt, Mission historian, "is all we find recorded anywhere about the church, the ruins of which are still seen

on the southern end of Lompoc at the foot of the mountain, within three blocks of the Catholic Church. We may presume that the dedication ceremonies took place on the titular feast, December 8, 1802, and that the Fathers of Santa Barbara Mission, as well as those of San Luis Obispo, participated in the festivities."

Between 1805 and 1808 the Mission fathers and their neophytes constructed an aqueduct, purchased 2,000 additional head of cattle and added to the mission buildings. It is interesting to note from old records that Fr. Mariano Payeras, reporting to the Fr. Presidente in January, 1810, wrote that he had completed compilation of "a large catechism with the acts of Faith, Hope and Charity, and another with what is necessary for salvation, a complete confesionario (a booklet explaining all about confession), and other little things, all in the language of these natives." It must have been some task.

The good Father also reported that the mission had 10,000 sheep and as many cattle. Temporal affairs at the mission were progressing steadily when calamity befell Purisima Concepcion in December, 1812.

NEW MISSION SITE

The earthquake of that year which created so much havoc at several of the California missions entirely destroyed the church and vestry, buried under the wall the various images and paintings, ruined the greater part of the church furniture and made uninhabitable most of the mission buildings. So great was the damage that the padres petitioned the Fr. Presidente and governor on March 11, 1813, for permission to remove the Indian community to another site and establish a new mission. Governor Arrillage granted the request and nine months later received a report which said, in part:

"This Mission of Purisima, founded in the plain south of the Rio Santa Rosa, or San Bernardo according to the map of Lopez, on the spot called Alsacupi by the natives and which was destroyed by the dreadful earthquake suffered from December 21 to the last days of the year 1812, was on April 23, 1813, moved to the dale called Los Berros by the Spaniards, but Amuu by these natives. The site of the new mission lies five quarter leagues northward of the old mission in the plain north of said river, on the Camino Real from Santa Ines to San Luis Obispo. It is 2,300 varas wide from west to east. While the old place lay away from the public highway, the new site is one league nearer to Santa Ines, and one-fourth league nearer to San Luis Obispo."



This fountain replaces the original one built by the founders of Mission La Purisima Concepcion

Ten days before the catastrophe the mission books had recorded 2,597 baptisms. In 1804 a total of 1,520 Indian neophytes were living happily at the mission.

FATHER PAYERAS HONORED

With supreme courage, Fr. Payeras and Fr. Ripoll set about building a new mission and by the end of 1813 had gathered about them 1,010 Indians. On July 24, 1815, the College of San Fernando de Mexico honored Fr. Payeras by appointing him Presidente of the California Missions.

During 1818 the temporary church collapsed, but another church was erected on the same site. This edifice, intended to be temporary, seems to have continued to be the permanent house of worship as records fail to show that it was replaced.

Worn out by his labors, Fr. Payeras died at his mission on April 28, 1823. Purisima Concepcion gradually was being impoverished by the excessive demands of the California military government that it contribute heavily to the support of the soldiers and their families. Money that the padres wished to devote to their new mission had to go to the army together with food and clothing.

OPPRESSION BY MILITARY

It was this oppression by the military that brought about the uprising of Purisima Indians on February 21, 1824, a revolt that spread to Santa Ines and Santa Barbara, as we have seen in the chapters on those two missions. A number of Indians were killed and seven were executed for their part in the affair, all of them young men. The older natives did not take part in the rebellion.

Jose M. Echeandia, first Mexican governor of California, arrived in 1825 and connived with young California politicos to seize Purisima Concepcion, along with the other missions. Final legislation confiscating the missions was not published until November 4, 1834, but for some reason haste was made to obtain the lands of Purisima and on November 30th of that year Domingo Carrillo was named civil commissioner to take over the property. The mission and its possessions were appraised at $61,976.37 less debts of $1,218.87, on February 18, 1835, and on March 1st delivery was made to Carillo.



Upper—Ruins of Mission La Purisima Concepcion before restoration work was begun *Byron Dome Photo*

What destruction was wrought at Purisima in a few short years is revealed by a report of William E. P. Hartnell, Inspector of Missions under the civil government and a friend of the Franciscans, submitted in January, 1839. Hartnell reported 122 Indians at the mission, most of them ill and in need of food and clothing. He ordered 300 cattle killed to purchase $800 worth of clothing for the neophytes.

During 1841-1842, Jose Antonio de la Guerra was administrator at Purisima and he is charged with having dissipated what was left of the mission property. Preceding chapters of this little history of the missions have dealt with the effort made by Governor Manuel Micheltorena to restore the missions to the Franciscans, of his banishment from the country by Pio Pico, who proclaimed himself Governor, and of Pico's sale of the California missions to various political friends. It is not necessary to repeat those sad facts here.

On December 4, 1845, Pico sold Purisima Concepcion to John Temple for $1,110.

"Thus," says Fr. Engelhardt, "came to an end Mission Purisima Concepcion within two days of the 58th anniversary of its founding by Fermin de Lasuen, the successor of Fr. Junipero Serra." (Continued on page 27)

Mission La Purisima Concepcion looks today exactly as it did in the years of its glory





This photograph shows what happened on the Bay Bridge when a cigarette was carelessly thrown into a truck load of mattresses

Bay Bridge Maintains Fire Department

By C. S. HAMILTON, Associate Bridge Engineer

CONSIDERING the current popularity of radio quiz programs, we offer as the $64 question, "What does a fire department do on a steel and concrete bridge?"

While such a question may have no particular meaning when applied to the ordinary river crossing, it is quite pertinent on the huge San Francisco-Oakland Bay Bridge. On this structure fire is of sufficient potential hazard to bridge property and the public as to warrant the employment of a permanent fire department as a unit of the bridge maintenance forces. Nor is this hazard merely a theoretical one. The history of the bridge since the opening day in November, 1936, to date, has amply justified the assignment of men, equipment, and material to this fire-fighting function. It could well be that the continued use of the bridge by its many patrons is due in no small part to the constant vigilance and ready availability of the bridge fire department.

The main bridge fire equipment is centrally located for speed in action. The fire station is housed at Yerba Buena Island at the approximate center of the bridge. Roadway connections at this point provide ready access to the upper and lower decks of the structure in either direction. Permanently stationed at this location is a modern fire truck equipped to cope with the particular fire situations that may arise on the bridge. From this central point the fire truck can respond in a few minutes to any point on the $12\frac{1}{2}$ miles of bridge and approach roadway and $4\frac{1}{2}$ miles of bridge railway under the jurisdiction of the San Francisco-Oakland Bay Bridge unit.

The fire truck is an American-La France unit on a G.M.C. chassis and carries the following equipment:

1 300-gal. water tank connected to a Byron-Jackson 2-stage centrifugal pump delivering 120 g.p.m. at 130 pounds pressure.

700 feet of $2\frac{1}{2}$-inch and $1\frac{1}{2}$-inch hose for the above unit for hydrant pumping and 150 feet of $\frac{3}{4}$-inch chemical hose.

40-gal. Foamite tank operated by compressed nitrogen and equipped with 200 feet of $\frac{3}{4}$-inch hose and shut-off nozzle.

1 running-board-mounted Model 10 Foamite generator with 100 feet of $1\frac{1}{2}$-inch hose and nozzle. Six 50-pound cans of Foamite compound are carried on the truck to serve the generator unit.

10 portable extinguishers made up by three $2\frac{1}{2}$-gallon Foamite units, two 1-gallon carbon tetrachloride units, two 15-pound carbon dioxide units, two 1-quart Pyrene units, and one $2\frac{1}{2}$-gallon plain water unit.

ADDITIONAL EQUIPMENT AVAILABLE

Auxiliary bridge fire-fighting equipment has been provided by installing small gasoline-engine-driven centrifugal pumps and hose on two 580-gallon truck-mounted water tanks normally used by the bridge painting crew for preliminary cleaning operations, and by installing a pump and pertinent equipment on the bridge maintenance boat *Active* for possible use on certain bridge piers having a timber protection fender. The *Active* is a 14-ton launch of 42-foot length and 12-foot beam powered by a 3-cylinder, 50 H.P. Corliss marine engine. The boat was used by bridge engineers during construction and on completion of that operation was assigned to the bridge maintenance forces. The fire-fighting equipment mounted on the boat consists of a Chrysler-Hale auxiliary fire pump of 500 g.p.m. rated capacity, 200 feet of 2½-inch and 1½-inch hose and a monitor nozzle mounted atop the pilot house. At the rated capacity the pump readily develops 125 pounds pressure.

All maintenance automotive equipment assigned to the bridge carries hand extinguishers which have been of frequent use in suppressing incipient fires without the necessity of calling for the larger units.

A 10-inch water main from San Francisco to Yerba Buena Island is installed on the West Bay crossing of the bridge. Fire hydrants at frequent intervals on this line provide ample water supply in case the portable supply should prove insufficient. A 12-inch water main now under construction from Oakland to Yerba Buena Island will shortly provide similar facilities on the East Bay crossing.

Harbor piers on the San Francisco waterfront, immediately adjacent to the bridge, are equipped with automatic sprinkler systems for bridge fire protection. These systems were installed by the bridge and are maintained by bridge forces.

COMMUNICATION SYSTEM

Reporting into the firehouse are the 54 fire alarm boxes distributed at intervals along the bridge and approach roadways for the use of the public and bridge employees. A terminal receiving instrument permanently records date, time, and location of all alarms transmitted on the system and, by the action of the fireman in resetting the box, records the same information for the response to a call.

The alarm system also reports each call and reset into the administration office of the bridge, located at the toll plaza. Auxiliary boxes at each end of the bridge connect the bridge system with San Francisco and Oakland systems so that the fire departments of these cities may be called if the bridge fire department needs outside assistance. A mutual aid arrangement has been agreed on with the Navy Fire Department at the Treasure Island Base, adjacent to Yerba Buena Island, thus providing another source of outside help on specific call.

Bridge maintenance phones provide additional communication into the firehouse and augment the coverage of the bridge alarm system.

The fire fighting forces are a part of the bridge maintenance and emer-

Maintenance boat "Active" throws a stream of water onto Bay Bridge during fire drill





Truck-mounted tanks are 580-gallon capacity equipped with small, centrifugal pumps for fire fighting purposes on Bay Bridge

gency service forces under the direct supervision of the Highway Maintenance Foreman. During the day shift, when assistance is readily available on the bridge, one fireman only is on duty at the firehouse. On the remaining two shifts, two men are assigned. Should a night emergency arise, maintenance employees can be summoned on reasonably short notice.

Permanent employees of the maintenance department have been given a six-day training course in the San Francisco Fire Department Training School. Twenty-three men have had this training to date and, while some of these employees are no longer with the bridge, there remain a nucleus adequate to cope with any emergency to be expected.

FIRES OF FREQUENT OCCURRENCE

Since the bridge opening the fire department has been called upon to extinguish some 420 fires, or an average of 4.2 fires per month. The average over the years 1943 and 1944 was slightly higher at 5.0 fires per month, reflecting, no doubt, the lack of maintenance on autos and trucks during the war years. Although the number of actual fires average but 5.0 per month, the bridge fire truck is called out on an average of about 14 times per month. These extra calls may be false alarms, standby service at wrecks, or other equally pertinent reasons.

As might be expected, the greater number of fires occur on vehicles, but railroad ties and grass, brush, and rubbish on bridge approaches have contributed a share to the record. Some selected figures may be interesting to the reader as typical of the duties the fire department performs and, incidentally, may indicate a few matters the motorist should watch for the protection of himself and others:

Type of Fire

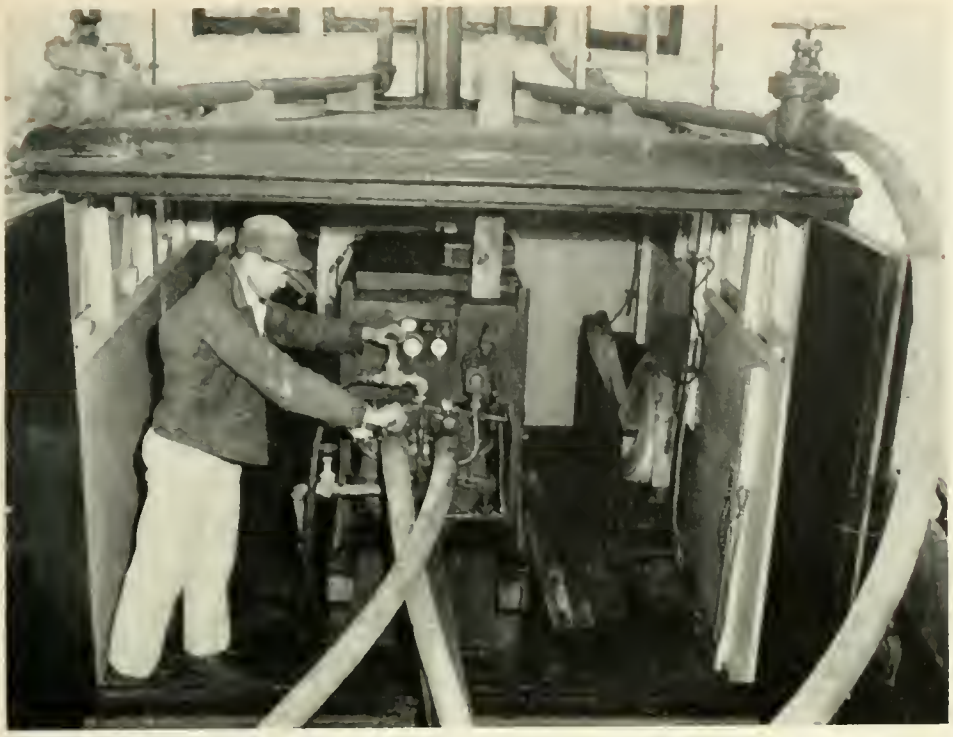
Auto	130
Truck	56
Bus	18
Railroad	27
*Miscellaneous	24

*Grass, brush, rubbish; fires on Yerba Buena and Treasure Islands, etc.

Contributing Factors

Brakes	33
Ignition	30
Motor trouble	16
Cigarette in upholstery	41
Fuel system	10
Exhaust system	32
Rags on motor	13
Cigarette in cargo	12
Wreck	10
Unknown	33

The majority of railroad fires occur in the timber ties as the result of a cigarette carelessly thrown from a passing truck, from insulation failure on the third rail, or from electrical shorts caused by metallic objects blown from trucks on the paralleling roadway. Nearly all such fires are minor in character and quickly extinguished, but one or two have occurred during periods of north wind with resultant low relative humidity. On these occasions the fire may be very persistent and difficult to extinguish. One such occurred on April 13 of this year. Located on the East Bay cross-



Closeup of auxiliary fire pump on boat "Active"

ing, it was caused by a sheet of corrugated iron blowing from a passing truck onto the railroad right of way to be subsequently caught in the third rail shoe of a passing train. The resulting series of shorts caused a sequence of fires extending over 1800 feet of track. Although the more serious part of the fire was limited to about 900 feet of track, a 20-mile north wind, combined with a relative humidity of 45, presented a difficult problem for fighting with the limited water supply.

On this occasion all available bridge equipment and outside aid from all sources previously mentioned were occupied for over an hour in extinguishing the fire. Train, truck, and bus traffic were delayed one hour and 40 minutes by the incident. Fortunately the quick response of fire apparatus prevented any structural damage to the bridge.

Fire truck unit operated by Bay Bridge



Bridge Maintenance

(Continued from page 8)

traffic constituted an important factor, sidewalks have been bracketed to the outside of through trusses in order to allow vehicles to utilize the full width of the roadway.

The improving of vertical clearances, particularly as restricted by portal and other diagonal bracing near the edges of the roadway, not only acts to prevent damage to the truss, but also adds to effective width by allowing the higher vehicles to hold to their half of the roadway. This is accomplished either by raising existing bracing or by replacing with a new section of equal strength which provides greater traffic clearances.

The recent replacement of the main trunion braces at the Petaluma Creek Bridge—before and after pictures of this repair being shown in **Photos 7 and 8**—is of this latter type. It was necessary to maintain adequate bracing at all stages of the repair since this bascule truss is raised several times each day for the passage of river traffic. The four-angle existing braces were separated and each pair of angles was successively removed, shortened, and bolted to the outside of the gusset plates, in order to allow the new sections to be inserted between the gussets. Self-locking bolts were used in lieu of rivets in attaching the new braces to the existing truss. The effective minimum vertical clearance was increased from 10 feet 6 inches to 14 feet by this repair.

THREE STATES INCREASE GAS TAX

Three States, Kansas, Idaho and Iowa, have increased their gasoline taxes in legislative sessions this year, reports to the National Highway Users Conference as of April 3d show. The one cent increase in Kansas will not become operative until after the war emergency and revenue derived from the increase will be applied to amortization of anticipation warrants, receipts from which will be used to match Federal-aid funds during the first three postwar years. The increase will expire when the warrants are paid in full.

The one cent boost in Idaho is for the purpose of matching Federal-aid highway funds and in Iowa two-fifths of the one cent tax raise will be used for secondary roads and the remainder will go to cities.

Gilman Street Improvement

By F. M. CARTER
Assistant Traffic Engineer

THE establishment of the Naval Force Equipment Depot on the bay side of the Eastshore Highway at Gilman Street increased the movement of heavy equipment and of pedestrian traffic to such extent that immediate attention was necessary.

For several years even though Gilman Street was a direct connection to a residential and business district in Berkeley, the majority of traffic proceeding to Oakland and San Francisco by the Eastshore Highway was using University Avenue.

Gilman was used largely by trucks and vehicles going to the city dumps. Even with the beginning of the war and the increase of vehicles on the Eastshore Highway, traffic was encouraged to use University Avenue because it was channelized and controlled by full actuated traffic signals. The majority of the movements from University Avenue were turning and the controls made safer and easier traffic movements.

The construction of the Golden Gate Turf Club again presented the problem of crossing the Eastshore Highway at the Gilman Street intersection and plans were made to handle the expected traffic, but this project did not materialize.

The traffic engineering studies made previously proved conclusively that the intersection would require left turn storage lanes and full traffic actuated signals, the same type as already in use on all other traffic controlled intersections on the Eastshore Highway.

With the full cooperation of the Public Roads Administration and the Navy, necessary priorities were obtained because this work was a war necessity.

The design for Gilman Street was the same as at other intersections on the Eastshore—three lanes for each direction of traffic on the highway and storage lanes for traffic turning left from the highway.

These storage or left turn lanes are indentations in the center divisional strip. On the Eastshore Highway the opposing traffic lanes are divided by a six-foot median strip, except at the channelized intersections where the divisional area is widened by moving the traffic lanes out on one or both sides.



This view of Gilman Street, looking north toward Richmond, with Albany overhead in distance, shows channelization with left turn lanes flaring to widen center strip

With the adequate channelization design the most advanced method of signal control was installed. The full traffic actuated system similar to that used at the other improved intersections on the Eastshore provides a traffic movement with the same car-second delay on both the highway and the cross street.

The heavy left turn movement, required a separate phase and the signal system provides three phases; a green period for traffic on the Eastshore, one for traffic crossing or turning on Gilman Street, and one for the left turn movement off the state highway. In addition the large pedestrian movement across the highway during change of shifts and the width of the highway necessitated pedestrian push buttons to provide a longer green interval for this type of cross traffic.

The type of traffic at this intersection also influenced the need for illumination of this area and six 10,000 lumen units to silhouette both the left turning vehicles and those passing the intersection and at the same time form a transition of brightness for vehicles leaving the intersection were installed.

This improvement proves that with an adequate traffic study based on facts, and a project designed and con-



Looking south on Gilman Street toward Bay Bridge. This picture shows flare on right lanes, raised bar division strip on each side of curbed islands, and widening of center divisional island to provide indentures for left-turn lane

structed on these facts, the results will be advantageous. With a traffic volume in twenty-four hours of 45,000 vehicles, a study of the accidents at University Avenue provides the results that may be expected at Gilman Street. A before and after study shows that accidents at this intersection have been reduced from 32 to 12 per year.

View of intersection on Gilman Street, showing left-turn lane and channelizing islands. Traffic lights look south toward Bay Bridge



In Memoriam

Earle David Davis

On the Honor Roll of employees of the Division of Highways who took military leave to serve with the armed forces there is a gold star after the name of Lt. Earle David Davis, Associate Highway Traffic Engineer, District VII, Division of Highways. Lt. Davis was killed in Normandy while serving with the Civil Engineers Corps, U. S. Navy.

Lt. Davis was born in Lead, S. D. on September 12, 1902. He came to work for the Division of Highways on October 17, 1922, and was continuously employed by the department until he went on military leave except for a period in 1924-25 when he returned to college and a period in 1926-27 when he was employed by Riverside County and the City of Riverside. On May 1, 1940, he was promoted to the position of Associate Highway Traffic Engineer.

On May 10, 1943, he was commissioned a Lieutenant in the Civil Engineers Corps, U. S. Naval Reserve, and reported to Camp Peary, Virginia, where he was assigned to duty with the Naval Construction Battalions.

He is survived by his wife, Thelma Elizabeth Davis, his son, Earle David Davis, Jr., and his daughter, Thelma A. Davis.

Deputy State Engineer To Enter Private Practice

HAROLD CONKLING, Deputy State Engineer, Division of Water Resources, has submitted his resignation to enter private practice as a consulting engineer in Los Angeles.

Mr. Conkling has been with the State Division of Water Resources and its predecessors for the past 24 years. He has been in charge of the administration of the water rights code of California since 1927 and in recent years has directed underground water investigations and water right determination in Raymond Basin and other areas in Southern California. He is well known through the Western States where irrigation is practiced as an authority on groundwater hydrology and water supply investigations.

In 1938 Mr. Conkling spent three months in South America as consulting engineer for the Government of Peru in connection with plans for water development and the formulation of water law for that country.

In Memoriam

Chester L. Caine

District VIII of the State Division of Highways is mourning the death of Chester L. Caine, who passed away at the age of 60 years.

Mr. Caine was one of the pioneer employees of the State Highway System, joining the organization in 1912 as a member of a survey crew. Earning steady promotions he transferred to District VIII with Headquarters in San Bernardino in 1929. For the past 15 years he served as Maintenance Superintendent. Mr. Caine made his headquarters in the City of Riverside during the latter part of his service.

His long service made him a member of the "25 YEAR CLUB" composed of State Employees of that length of service. He was a charter member of San Bernardino Chapter No. 7 of the California State Employees' Association.

His industry, faithfulness to his work, and thorough understanding of maintenance practices were the outstanding characteristics of Mr. Caine. He could always be relied upon to be out in stormy weather, day or night, patrolling the highways under his care, to make sure they were safe and passable for the traveling public.

Mr. Caine is survived by his widow, Mrs. Eletta Belle Caine of Riverside.

Progress and Records in Pavement Construction During 1944

(Continued from page 11)

it is necessary to hold the plant temperature to a range of 180 to 200 degrees for the 200 to 300 penetration asphalt, and 225 to 260 degrees for the 150 to 200 penetration.

The elimination of fines in the open graded type results in a mixture that is practically free from the difficulties usually encountered when water is trapped in dense graded surfacing during construction.

The open graded surface generally has better riding qualities than the dense graded surfacing since the spreading machines seem to work more efficiently with this type of mix. The surface texture of an open graded mix is ideal for uniformity; however, it is highly permeable and is not suitable where water-proofing of the road foundation is essential. The cost of the open graded mixture is greater than the dense grading, due to the elimination of the finer sizes which are usually of natural, unprocessed material. It is believed that the saving in maintenance costs, in a great many areas where native fines are not too favorable, will more than offset the increased initial cost.

Road-Mix

The road-mixed method of construction was used on about 23 per cent of the bituminous treated mileage laid in 1944. Of this mileage, only about 8 per cent was mixed with blade graders, the bulk of work being constructed with mixing machines. Some of these mixers were set up at the source of material and used much as a mixing plant, except that the aggregate was not put through a dryer.

Armor Coat

The principal objection to armor coat surfacing is that the present method of construction requires ideal weather conditions. Should the weather become unfavorable during construction, full penetration of the dense course of screenings becomes impossible, and subsequent failures appear in the finished surface.

A method of procedure was worked out by construction personnel in District I, on a nine-mile project in Humboldt County between Trinidad and Little Red Hen, in which multiple courses were successfully constructed. This insures full penetration at air temperatures impossible under former methods, and has resulted in a smoother riding pavement. This procedure was described in the November-December, 1944, issue of California Highways and Public Works, and is being adopted as standard for future armor coat construction.

RECORDS, BITUMINOUS TREATED SURFACES

The record for **surface smoothness** on the 74 plant-mixed projects, involving about 400 miles of road surface, was made on Contract 3WC1, 111-Yub.-Sut.-3, 87, Var., 4 sections on Routes 3 and 87, where the roughness index averaged but 7.4 inches per mile. Lester L. Rice was the contractor, with F. D. Hillebrand, resident engineer.

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CALIFORNIA MISSIONS

(Continued from page 19)

President Abraham Lincoln had returned to the Catholic church a number of the Franciscan missions and on January 24, 1874, President Ulysses S. Grant gave back to the church all that remained of Purisima Concepcion.

Deserted by its devoted priests and the Indian neophytes, the mission rapidly decayed and in 1882, Mrs. Helen Hunt Jackson, United States Indian Inspector, describing the California missions, wrote: "The most desolate ruin of all is that of La Purisima Concepcion Mission. Nothing is left there but one long, low adobe building, with a few arches of the corridor; the door stands wide open, the roof is falling in; it has been so often used as a stable and sheepfold, that even the grasses are killed around it. * * * Many of the trees are gone, and those that remain stretch out gaunt and shriveled boughs, which, though still bearing fruit, look like arms tossing in vain reproach and entreaty."

Twenty-three years later, George Wharton James, in 1905, wrote "Everything at Purisima Concepcion now is in sad ruin."

Fr. Engelhardt says that after the spoilation and abandonment of the mission, the whole valley became a sort of wilderness, even the Indian rancherias gradually disappeared.

In October, 1874, the country surrounding the old mission was divided into farms and town lots and settlers established what now is the city of Lompoc. A Catholic community grew up around Lompoc largely due to the efforts of Rev. J. B. McNally, who was in charge of the seminary near Mission Santa Ines. In 1910, Fr. John Reynolds took over as resident priest at Lompoc, where a Catholic church had been erected. He was succeeded by Rev. Charles N. Raley in 1912, which was the 125th anniversary of the founding of Mission Purisima, whose ruins stood only three blocks from the church.

And with the coming of Fr. Raley there began a new era for La Purisima Concepcion. He inspired a civic celebration held December 5, 1912, in observance of the mission anniversary and a huge cross was raised on the hillside facing the ruins of the first mission. Bishop Thomas J. Conaty of the diocese of Los Angeles and Monterey attended with many church dignitaries, state and county officials, representatives of the Native Sons and Native Daughters, and himself blessed the cross that now stands at Lompoc and by night is illuminated with electric lights.

Some 10 years before, the Union Oil Company of California had acquired the Mission lands. The officials of the company decided to encourage a movement to start restoration of the mission and in 1905 the old residence building site was deeded to the Landmarks Club with the provision that the club would provide $1,500 for repair work. This sum was not forthcoming and title reverted to the Union Oil Company.

Definite plans for restoration of the mission were laid in November, 1914, at a meeting called by Father Raley, but it was not until 1934 that by deed of gift, titles to the church ruins and the monastery ruins were transferred to the county of Santa Barbara by the Catholic Church and the Union Oil Company, respectively, and the county and State of California jointly purchased additional lands, making a total of 507 acres. This property was then deeded to the Division of State Parks, and was given the name of La Purisima Mission State Historical Monument. The State requested the National Park Service to establish a Civilian Conservation Corps camp at the site and to undertake the restoration of the mission buildings in cooperation with the Division of Parks. On August 2, 1934, rehabilitation work was begun.

RESTORATION UNDERTAKEN

On July 7, 1935, the first adobe brick was laid and construction of the first unit of the monastery, based on painstaking research, was started. The monastery building alone required the molding of 110,000 adobe bricks, 32,000 roof tiles, and 10,000 floor tiles.

Today, La Purisima Concepcion has regained its former outstanding place among California missions.

Mission visitors motoring north from Santa Barbara have the choice of two routes to Purisima Concepcion, one by way of San Marcos Pass, State Route 80, to Buellton and Santa Ines Mission, thence west from Buellton to the Coast Highway, State Route No. 2, and then 16 miles on State Route 149 to Lompoc; and the other by way of the Coast Highway, State Route No. 2, U.S. 101, to Las Cruces and thence northwest 22 miles to Lompoc.

Coming from the north the way is by State Route No. 2 from San Francisco through Santa Maria to Orcutt, thence south seven miles on the Coast Highway to its junction with State Route 56, thence southwest to Lompoc.

Or coming from the north, the mission visitor may motor over the Valley Route, State Route No. 4, to Bakersfield, thence south and west to Taft and Maricopa west on State Route No. 57 to Santa Maria, south through Orcutt to the junction of State Route 56 and the Coast Highway, and then west to Lompoc, situated in the fertile Lompoc valley, known as "The Valley Beautiful."

Any of these routes make a delightful scenic trip. The visitor to Mission Purisima Concepcion also may reach Lompoc from the south or north over the Southern Pacific lines.

Next—Mission San Luis Obispo de Tolosa and Mission San Antonio de Padua.

Former Highway Employee Wins Commendation

FRIENDS of Lt. Keith Kenfield, on military leave from the San Francisco-Oakland Bay Bridge, read with interest an article by Major General A. D. Bruce, commander of the 77th Division, which appeared in a recent issue of a magazine of national circulation.

In the article, General Bruce paid high tribute to Lt. Kenfield and other officers and men of the 77th Division for heroic conduct in the battle of Guam. Lt. Kenfield continued in action after being wounded in the neck by a Jap bullet.

In a tribute to his outfit, General Bruce said, "Several times I have made the statement that I am proud to belong to the 77th Infantry Division. There are many reasons why I am proud—reasons that such men as these provide. Schaefer, Vozza, Miller, Tiernan, Koeberle, Hatch, Reidda, and Kenfield are not professional soldiers. They were just ordinary American citizens who, before this war overtook them, never thought they'd face an enemy on the field of battle. To all of them, Guam offered their first taste of combat, but they took it like veterans. Each man stood fast and did the job he had been trained to do and a little bit more on top of it."

Highway Bids and Contract Awards

April 1945

COLUSA COUNTY—Portions between Yolo County line and Grimes, about 3.8 miles, to be repaired with road-mixed surfacing. District III, Route 88, Section A. Lee J. Immel, Berkeley, $16,606; M. J. Ruddy & Son, Modesto, $19,920; K.R.C. Construction Co., Berkeley, $21,922; W. C. Railing, Redwood City, $22,407; J. P. Breen, Sacramento, $22,754; A. Teichert & Co., Sacramento, $27,908. Contract awarded to R. A. Westbrook, $16,329.

IMPERIAL COUNTY—Between south gate of Seeley Airport and Route 12, about 1.0 mile to be surfaced with road mixed surfacing, and between Route 187 and Holtville Airport, about 5.4 miles, a bituminous surface treatment to be applied to shoulders. District XI. Dimmitt & Taylor, Los Angeles, $17,494; Basich Bros. Construction Co., Alhambra, $19,487. Contract awarded to Arthur A. Johnson, Laguna Beach, $15,364.

LASSEN AND MODOC COUNTIES—Portions between Horse Lake Road and Lakeview Junction and between Alturas and Stronghold, about 60 miles to be repaired with plant mixed surfacing and seal coat. District II, Routes 73, 28, 210. Harms Bros., Sacramento, $129,070; Contract awarded to A. A. Tieslau & Son, Berkeley, $126,126.

MADERA COUNTY—Between 6.7 miles north of Madera and Merced County line, about 4.8 miles to be repaired with plant-mixed surfacing. District VI, Route 4, Sections B, C. A. Teichert & Co., Sacramento, $43,651; J. E. Haddock, Ltd., Pasadena, $44,793; N. M. Ball Sons, Berkeley, $45,091; Louis Biasotti & Son, Stockton, $46,169; M. J. Ruddy & Son, Modesto, $48,348; A. A. Tieslau & Son, Berkeley, $48,561; J. Henry Harris, Berkeley, $49,971. Contract awarded to W. C. Railing, Redwood City, $42,697.

PLACER COUNTY—Between Auburn and Bear River, portions only, about 3.2 miles, to be repaired with plant-mixed surfacing on existing roadbed and on new crusher run base borders. District III, Route 17, Aub., C. McGillivray Construction Co., Sacramento, $31,157. Contract awarded to R. A. Westbrook, Sacramento, $25,430.

RIVERSIDE COUNTY—Between Desert Center and Black Butte, portions, about 12.7 miles to be repaired with road-mixed surfacing. District XI, Route 64, Sections C, D. Arthur A. Johnson, Laguna Beach, $51,512; Vinnell Co., Alhambra, $54,645; The Tanner Construction Co., Phoenix, $59,425; Dimmitt & Taylor, Los Angeles, $67,375; Guerin Bros., Los Angeles, $76,305; Owl Truck & Construction Co., Compton, $79,785; Basich Bros. Construction Co., Alhambra, $82,509; Matich Bros., Colton, $89,950. Contract awarded to R. R. Hensler, Glendale, $41,965.

TULARE COUNTY—Between Quail Station and 6.5 miles north of Goshen, about 13.5 miles, to be repaired by placing plant-mixed surfacing and applying seal coat thereto. District VI, Route 4, Sections B, E, F. Griffith Company, Los Angeles, $125,066; Union Paving Co., San Francisco, $129,434; W. C. Railing, Redwood City, $136,674; A. Teichert & Co., Sacramento, $139,925; Louis Biasotti & Son, Stockton, $149,015; J. E. Haddock, Ltd., Pasadena, $150,304; M. J. Ruddy & Son, Modesto, $151,554; N. M. Ball Sons, Berkeley, $153,488; Guerin Bros., South San Francisco, $172,367. Contract awarded to Brown, Doko & Baun, Pismo Beach, $118,504.

May 1945

ALAMEDA COUNTY—Between Mission San Jose and Warm Springs, about 2.4 miles to be repaired with crusher run base and plant-mixed surfacing. District IV, Route 5, Section C. Clements & Co., Hayward, $50,913; Lee J. Immel, Berkeley, $51,779; A. J. Raisch, Paving Co., San Jose, $51,893; N. M. Ball Sons, Berkeley, $52,937; Granite Construction Co., Watsonville, $53,329; Frederickson Bros., Emeryville, $54,049; J. Henry Harris, Berkeley, $54,255; W. C. Railing, Redwood City, $59,075; Louis Biasotti & Son, Stockton, $61,026. Contract awarded to A. S. Jones, Napa, $45,188.

ALAMEDA COUNTY—Between Warm Springs and Centerville, about 6 miles to be repaired with crusher run base on portions and with plant-mixed surfacing on existing roadbed and on new crusher run base. District IV, Route 69, Section A. Clements & Co., Hayward, $107,277; Louis Biasotte & Son, Stockton, $107,846; N. M. Ball Sons, Berkeley, $109,079; Frederickson Bros., Emeryville, $118,000; A. J. Raisch Paving Company, San Jose, $118,065; Lee J. Immel, Berkeley, $118,300; C. M. Syar, Vallejo, $123,351; Granite Construction Co., Watsonville, $125,930; Frederickson & Watson Construction Co., Oakland, $133,738; Chas. L. Harney, San Francisco, $134,679. Contract awarded A. S. Jones, Napa, $105,040.

BUTTE COUNTY—About 2.5 miles east of Jarboe Pass to be repaired by constructing reinforced concrete cribbing and restoring a portion of the roadbed. District II, Route 21, Section C. Kiss Crane Co., San Pablo, $28,126; J. P. Brennan, Redding, $28,456; C. C. Gildersleeve, Willows, $29,316; W. C. Thompson, San Francisco, $51,305. Contract awarded to E. B. Bishop, Orland, $26,261.

CONTRA COSTA COUNTY—Between Brentwood and 4 miles southeasterly, a distance of about 4.2 miles to be repaired with crusher run base and plant-mixed surfacing. District IV, Route 75, Section D. Clements & Co., Hayward, $84,717; Elmer J. Warner, Stockton, $88,609; A. J. Raisch Paving Co., San Jose, $89,543; W. C. Thompson, San Francisco, $89,957; N. M. Ball Sons, Berkeley, $90,807; Louis Biasotti & Son, Stockton, $92,194; Frederickson & Watson Construction Co., Oakland, $93,525; C. M. Syar, Vallejo, $95,587; Lee J. Immel, Berkeley, $99,737. Contract awarded to Frederickson Bros., Emeryville, $84,640.

HUMBOLDT COUNTY—Between Loleta and Patrick's Point, portions only, a net distance of about 7.5 miles, to be repaired by placing plant-mixed surfacing on imported base material and applying seal coat to the plant-mixed surfacing and prime coat on the shoulders. District I, Route 1, Sections G, I, J. N. M. Ball Sons, Berkeley, $179,668. Contract awarded to Mercer, Fraser Company, Eureka, $170,953.

IMPERIAL COUNTY—Between Route 26 north of Calexico and Calipatria, portions only, about 13.4 miles to be repaired with imported base material and road-mixed surfacing. District XI, Route 201, Sections A, B, C, Slu. The Tanner Construction Co., Phoenix, $128,375; Basich Bros. Construction Co., Alhambra, $131,937; Dimmit & Taylor, Los Angeles, $190,715. Contract awarded to Norman I. Fadel, North Hollywood, $115,650.

KERN COUNTY—Between Route 145 near Rademacher and Inyokern-Trona Road, about 8.2 miles to be graded and bituminous surface treatment applied. District IX, Route-Inyokern Ordnance Sta. R. R. Hensler, Glendale, $68,963; Vinnell Company, Alhambra, $71,103. Contract awarded to Arthur A. Johnson, Laguna Beach, $68,532.

LOS ANGELES COUNTY—Between Latigo Canyon and one mile westerly of Malibu Creek, about 3.3 miles to be repaired with plant-mixed surfacing over existing pavement and shoulders and seal coat to be applied to shoulders. District VII, Route 60, Section A. Southwest Paving Co., Roscoe, $44,015; Vido Kovacevich Co., Southgate, $51,525; Oswald Bros., Los Angeles, $56,445. Contract awarded to Schroeder & Co., Roscoe, $43,070.

VENTURA COUNTY—Between the city of Ventura and Ojai, portions only, a net length of about 2.1 miles, to be repaired with plant-mixed material. District VII, Route 138, Section A. Schroeder & Co., Roscoe, $35,410; Frontier Construction Co., Whittier, $35,760; Griffith Co. Los Angeles, $36,684. Contract awarded to Oswald Bros., Los Angeles, $35,400.

Report on Progress and Records in Pavement Construction During 1944

(Continued from page 26)

Eighty-seven per cent of plant-mixed projects were for repairs of existing surfaces. Surface smoothness for the entire State averaged 16.8 inches per mile, compared to 18.8 inches in 1943.

The record for **road-mixed surfaces** was made on Contract 11ASCl, XI-S.D-Access, Camp Lockett to Route 200, where 15.2 inches per mile was averaged by B. G. Carroll, contractor, with R. C. Payne, resident engineer. The average for the State was 32.9 inches per mile, compared to 22.4 inches in 1943.

The record for **armor coat surfaces** was made on Contract 1TC3, 1-Hum-1, J, Trinidad to Little Red Hen, where 21.3 inches per mile was averaged by Marshall S. Hanrahan, contractor, with H. M. Hansen, resident engineer. The State average was 48.3 inches, compared to 48.1 inches in 1943.

Ends Long State Service

For 21 years Maintenance Engineer of District VIII, Division of Highways, with headquarters in San Bernardino, Joseph E. Stanton has resigned from State service to enter private business in Los Angeles.

Mr. Stanton's career with the Division of Highways began in the summers of 1913 and 1914 while he was enrolled at the University of California. Following his graduation as an engineer in 1915, Mr. Stanton was employed as an assistant to E. Q. Sullivan, present District Highway Engineer of District VIII, who was then stationed at Corning in District II. When the San Bernardino district was formed 21 years ago with Mr. Sullivan in charge, Mr. Stanton, then a highway superintendent at Big Bear, was selected by Mr. Sullivan as maintenance engineer.

State of California

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C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney

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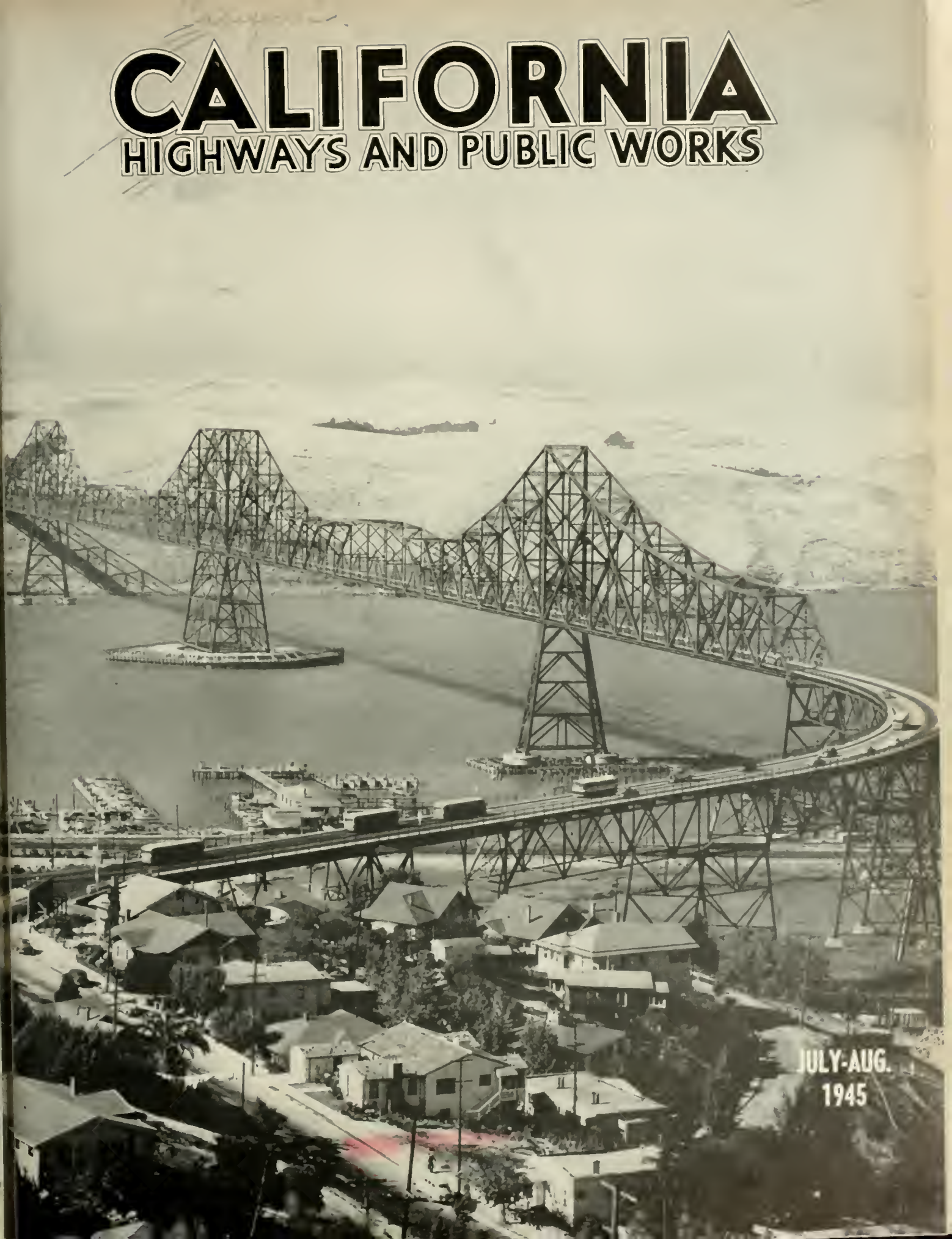
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CALIFORNIA
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Study Shows Accidents on Arroyo Seco Parkway are Less Than on Some Los Angeles City Streets

By R. E. PIERCE, Principal Highway Engineer

THE elimination of pedestrian deaths and intersection accidents, and a considerable reduction in motor vehicle accidents involving injuries and fatalities between intersections, is shown by a recent study of accidents for the four years from 1941 to 1944, inclusive, on the Arroyo Seco Parkway between Los Angeles and Pasadena as compared with Los Angeles city streets of comparable traffic volume.

The accompanying table shows various accident items all based on million vehicle miles for the years 1941 and 1944. For purposes of comparison these years were selected because 1941 was the last prewar year and 1944 the last available war year.

It is obvious that the Arroyo Seco Parkway with its built-in features of three traffic lanes on each side of a curbed raised central dividing strip, with good standards of alignment, no street or railroad crossings at grade, no pedestrians, and turning movements across traffic eliminated, is more convenient, comfortable and economical for motor vehicle operation than city streets of comparable traffic volume without these features. These same built-in features also increase the safety of traffic. Just what has been accomplished in the reduction of accidents and added convenience, however, has not heretofore been compiled in actual comparable terms.

A glance at the accident rates per million vehicle miles in the table shows that the rates for the Arroyo Seco Parkway and Riverside Drive (which is in effect an undivided freeway) are quite similar, but all the rest are much higher for both years.

Riverside Drive has certain features in its design differing from the Arroyo Seco Parkway. These are:

(1) No outer curbs, which gives traffic more freedom of movement;

(2) Improved shoulders, allowing disabled cars to park clear of the roadway; and,

(3) In addition to there being no intersecting or cross streets there are no access connections such as the parkway has.

These features may explain to some extent the slightly lower rates for Riverside Drive which we find in the table, especially in the "All Fatalities" column, for both years.

A study of the causes for accidents on the parkway shows that a few approaching accidents occurred due to illegal movement of cars traveling in the wrong direction. Other accidents were caused by cars striking curbs, ramp dividers and disabled vehicles parked on the traveled way.

Consideration of the causes for these types of accidents will result in design changes in future freeways, which should eliminate a considerable proportion of these types of accidents and make the future freeways show an even better accident record.

The rates shown at the bottom of the table for all California Rural State Highways, are not comparable with city street rates, but are interesting as they show that the rates for the Arroyo Seco Parkway and Riverside Drive are much lower, in spite of the much heavier traffic they carry, when compared with the rural State highways as a whole.

Time saving, previously mentioned, is an important factor on the parkway; this was verified by making test runs with an automobile "floating" with the traffic in order to get as near the average speed of the traffic as possible.

A Comparison of Accidents 1941 and 1944 Per Million Vehicle Miles

Location	Average Daily Traffic	Injuries and Fatal Accidents Day	Injuries and Fatal Accidents Night	All Injury and Fatal Accidents	All Injuries	All Fatalities	Pedestrian Fatalities	2 Car Accidents—Course of Vehicles Approaching	2 Car Accidents—Course of Vehicles Overtaking	2 Car Accidents—Course of Vehicles Intersection
1941										
Arroyo Seco Parkway	27,234	0.139	0.347	0.486	0.555	0.035	----	0.052	0.156	----
Riverside Drive	27,119	0.202	0.289	0.491	0.722	0.029	----	0.173	0.173	----
Figueroa Street—Manchester Ave. to Vernon Ave.	25,090	2.184	2.256	4.440	5.335	0.322	0.251	1.146	1.110	1.074
Figueroa Street—Vernon Ave. to Washington Blvd.	32,207	1.258	1.664	2.922	3.181	0.074	0.074	0.444	0.444	1.073
Wilshire Boulevard	39,300	1.095	1.444	2.539	3.421	0.045	0.045	0.623	0.912	0.319
State-Rural State Highways	-----	----	----	1.174	1.993	0.145	0.036	0.361	0.301	0.241
1944										
Arroyo Seco Parkway	21,488	0.176	0.198	0.374	0.549	0.044	----	0.017	0.087	----
Riverside Drive	21,404	0.146	0.256	0.402	0.805	----	----	0.146	0.073	----
Figueroa Street—Manchester Ave. to Vernon Ave.	19,368	1.391	2.319	3.710	5.566	0.092	0.046	0.464	1.484	0.788
Figueroa Street—Vernon Ave. to Washington Blvd.	20,873	1.293	1.533	2.826	3.689	0.096	0.096	0.527	0.910	0.383
Wilshire Boulevard	31,389	1.088	1.258	2.346	3.285	0.056	0.038	0.375	0.901	0.319
State-Rural State Highways	-----	----	----	0.986	1.678	0.136	0.041	0.330	0.310	0.410



Traffic is safely handled on Arroyo Seco Parkway with divided lanes, overheads and on and off ramps

These test runs taken during the heavy traffic periods, 4 to 6 p.m., on the parkway and city streets gave the following results:

ARROYO SECO PARKWAY—5.80 MILES

From San Fernando Road, Los Angeles, to Glenarm Street, Pasadena. Average speed 40.2 m.p.h.

RIVERSIDE DRIVE—3.50 MILES

From Los Feliz Boulevard to Hollingsworth Drive. Average speed 10.1 m.p.h.

In contrast, test runs made on Figueroa Street and Wilshire Boulevard gave the following results:

FIGUEROA STREET—5.35 MILES

From Manchester Avenue to Washington Boulevard. Average speed 17.2 m.p.h.

WILSHIRE BOULEVARD—4.65 MILES

From East City Limits of Beverly Hills to Vermont Avenue. Average speed 23.3 m.p.h.

During periods of light traffic the speed on the freeways could be considerably increased without serious hazard, but on the other streets due to the many stops on account of traffic signals the speed could increase very little.

Accident records for the four years 1941 to 1944 inclusive were collected in this study. The total accidents on the streets used in this study involving injuries and fatalities for these years are as follows:

Arroyo Seco Parkway	114
Riverside Drive	102
Figueroa Street—Manchester Avenue to Vernon	511
Figueroa Street—Vernon to Washington	309
Wilshire Boulevard	710

This further emphasizes the advantage of the freeway type of highway.

The streets used in this study were: Riverside Drive from Los Feliz Boulevard to Hollingsworth Drive; Figueroa Street from Manchester Avenue to Washington Boulevard; and Wilshire Boulevard from east city limits of Beverly Hills to Vermont Avenue.

Herewith are brief descriptions of the Arroyo Seco Parkway and the three streets.

ARROYO SECO PARKWAY

That portion from San Fernando Road to South City Limit of Pasadena, 5.80 miles.

The pavement on each side of the curbed dividing strip is 35 feet wide between curbs, each divided by two traffic stripes into three lanes, the center lane 11 feet in width, the two outer lanes 12 feet wide. The portion from San Fernando Road to the west-

erly city limits of South Pasadena (4.30 miles) is provided with lighting units on arms projecting from standards along the outside curbs. The balance through South Pasadena (1.50 miles) is unlighted.

At appropriate and convenient locations, inlets and outlets are provided by means of one-way roads or ramps with widened pavement at these points for blending with or withdrawing from the faster moving traffic on the main freeway.

Parking on the main freeway is prohibited, as are pedestrians.

RIVERSIDE DRIVE

From Los Feliz Boulevard to Hollingsworth Drive, 3.50 miles.

This stretch of road is a 40-foot four-lane undivided asphalt pavement with oiled shoulders four to six feet wide. It is divided into four 10-foot lanes by a double center stripe and a single stripe 10 feet each side of this center stripe. Situated as it is along the westerly bank of the Los Angeles River and with no intersecting streets, it is in effect an undivided freeway and was selected for that reason. Small, widely spaced lights along one side of the road add very little to improve visibility at night. Parking is prohibited throughout.

In addition to having no intersecting or cross streets it also has no inlets or outlets which the Arroyo Seco Parkway has.

FIGUEROA STREET

From Manchester Avenue to Washington Boulevard, 5.35 miles.

That portion from Manchester Avenue to 37th Street runs practically due north; at 37th Street there is about a 30° angle northeast.

The pavement is asphaltic and is 66 feet in width between curbs. There is a double painted white stripe in the center and a single painted white stripe 10 feet each side of the center stripe. Parallel parking in an 8-foot width is permitted for the entire distance between Manchester Avenue and Washington Boulevard. This marking provides four lanes, the outer lanes being 15 feet wide between the outside stripes and the parking lane.

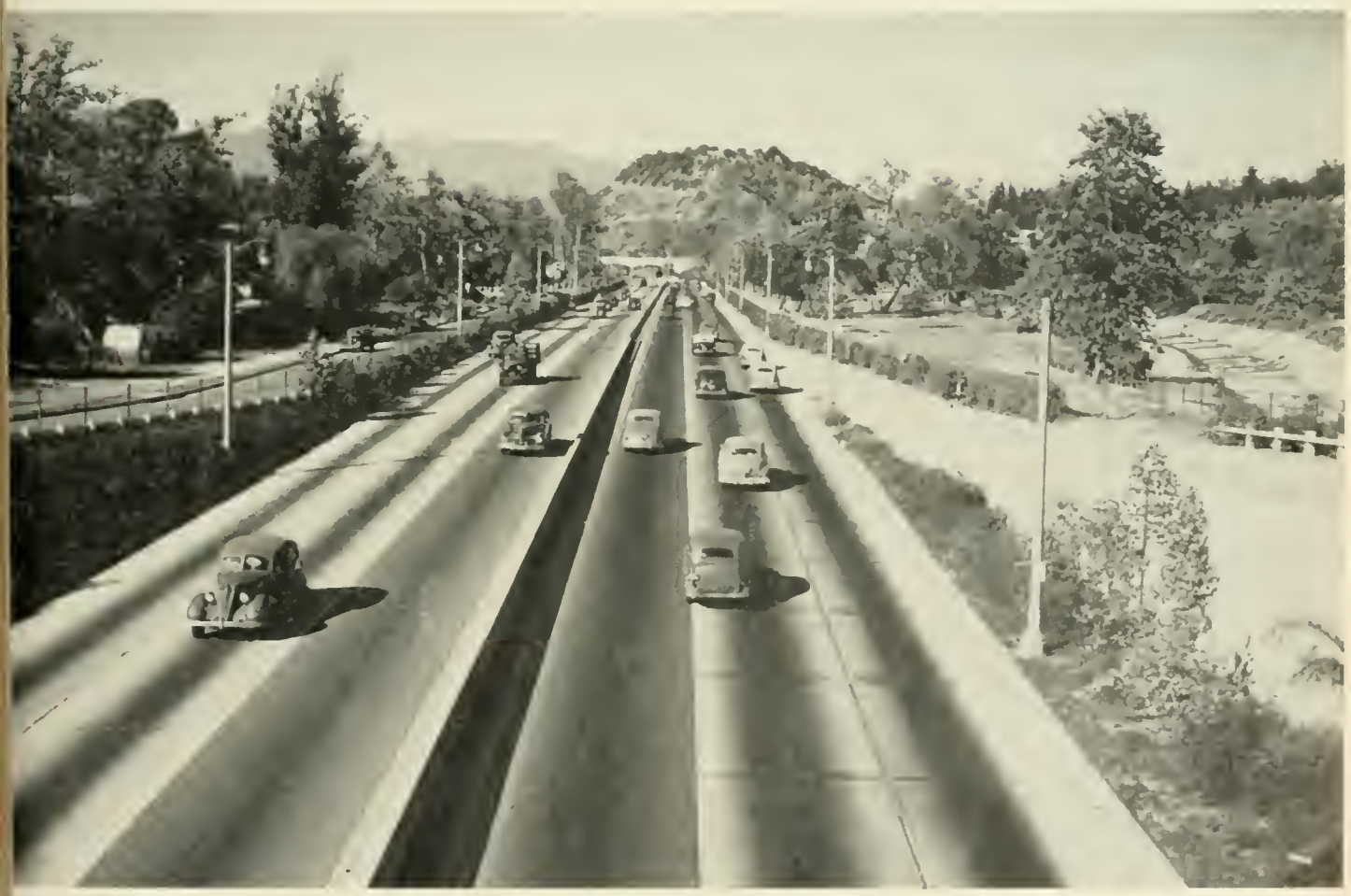
Lighting: From Washington Boulevard to Vernon Avenue, a distance of 2.30 miles, the lights are on the old style cast iron standards placed along the curb with two light units. From Vernon Avenue to Slauson Avenue, a distance of about one mile, single arc lights are suspended over the centers of the intersections.

From Slauson Avenue to Manchester Avenue, the light standards are similar to those between Washington Boulevard and Vernon Avenue, but only one of the light units are lighted. Hence for this study we have divided Figueroa Street into two parts: (1) the better lighted section from Washington Boulevard to Vernon Avenue, 2.30 miles; and (2) the poorer lighted section from Vernon Avenue to Manchester Avenue, 3.05 miles.

Nineteen intersections are controlled by automatic signals; of these four are the three-light type, the balance being

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Riverside Drive is a typical undivided freeway



HIGHWAYS OF CALIFORNIA

By J. D. GALLAGHER, Associate Highway Engineer

OF the 48 States none holds greater variety in terrain and climate than may be found in the 159,000 square miles of California. Extending about 200 miles inland from the Pacific along some 800 miles from Mexico to Oregon, the State encompasses almost all that there is in the way of temperate climate and geologic formation.

The coast line varies from wide beaches to rocky bluffs and headlands. The broad valleys of the Sacramento and San Joaquin present typical midwestern agricultural land, hemmed in by the semibarren Coast Range on the west and the towering snow-capped Sierra on the east. The drifting sand dunes of the great Mojave Desert are arid in the extreme, while in the redwood country adjacent to the north coast the annual rainfall is 70 inches and more. The rugged terrain of southern portions of the State is broken with fertile valleys, green with citrus groves. The Imperial Valley, in the extreme southern portion of the State consists of a millenium of silt deposits upon an ancient ocean floor made productive by water from the Rockies a thousand miles away.

Joining these diverse sections into a unit are the 14,000 miles of road in the California State Highway System. Spreading over the State, this network of highways is composed of main arteries running north and south with major laterals to the east and west. Stemming from these principal routes are the secondary roads acting as traffic feeders.

MANY PROBLEMS

Development and maintenance of these State highways, traversing desert, mountains, valleys and coast of California, present problems of such variety as to challenge engineering ability and practice.

By the average motorist, modern highways are taken for granted. Travel over bridges and mountains, through tunnels and passes is accomplished with little or no thought of obstacles overcome in their construction and maintenance. A few moments over a bridge that was many months in erection; a few seconds through a tunnel which took a year or more to bore; a few hours, and an entire mountain range is crossed, the same range which took "'49'ers" weeks to overcome—all are traveled with such speed and comfort that it would seem their construction must have been simple.

The factual data behind the stories of the development of the various routes in the California State Highway System are many and varied. Some reveal victory over seemingly insurmountable obstacles of nature; others are interwoven with the romance which was early California, and still others are the prosaic story of just keeping everlastingly at it. It might be that motorists could more appreciate their travels along California's highways if they were familiar with the stories behind them.

REDWOOD HIGHWAY

For many years construction and maintenance operations on the Redwood Highway (U. S. 101 north of San Francisco) have been complicated by numerous frequent slides and slipouts through the mountainous areas of heavy rainfall along the northern coast country. The same extreme in moisture, which during the past 2,000 years has produced the famous groves of towering redwoods, has made provision of stable foundations most difficult and unique methods of engineering practice are frequently necessary to meet the problems of saturated subsoils.

An example of unusual construction practice on this route occurred in 1934 on the relocation of nine miles between Last Chance Slide and Flannigan's just south of Crescent City in Del Norte County. This revised alignment followed a line back from the ocean shore and through relatively dense redwood growth. While every effort was made to preserve the groves it was necessary to fell a few large trees ranging to 17 feet in diameter and rising to from 250 to 300 feet into the sky. At that time, commercial disposition of the trees in the vicinity was impractical, so with the knowledge that redwoods, even though buried, will remain for decades in a remarkable state of preservation, decision was made to use the timber in construction of roadway fills.

The felled trees were cut into convenient sizes and nearly 10,000,000 board feet of timber were used in fill construction providing the equivalent of more than 30,000 cubic yards of earth embankment. By elimination of long shallow fills adjacent to the redwood embankments the area occupied by them was much less in extent than would have been required by a conventional earth fill.

FLOOD DAMAGE

The appellation of "Redwood Highway" to this route is doubly applicable to this section in Del Norte County.

Back in 1922, the State was constructing a triple reinforced concrete arch bridge on the Redwood Highway across the Van Duzen River in Humboldt County, paralleling a bridge of the Northwestern Pacific Railroad. The river was practically dry and traffic was being routed over a small temporary timber structure. On October 25th it started to rain and in a few days Humboldt County experienced the heaviest storm of 76 years. On the morning of October 28 the flooded river carried out the temporary detour bridge. Traffic was then routed over an old county bridge, but it was washed away that afternoon.

Permission was immediately secured from railroad officials to lay a temporary floor on the railroad bridge and use it for a detour crossing. By 1 o'clock on the afternoon of October 29th the first truckload of lumber was delivered to the bridge and at 8 a.m. on November 1st the first automobile crossed the railroad bridge. Gates were built on the approaches, temporary semaphores were erected and deputy sheriffs and railroad flagmen placed to control traffic. Members of the Highway Commission signed waivers releasing the railroad from all liability and in turn those using the bridge were required to sign waivers in favor of the commission. As soon as the flood subsided a single-lane pile bridge was built across the river for the detour traffic and the use of the railroad bridge discontinued. Approximately 1,000 feet of the bridge was floored, using some 53,000 feet of lum-



This is the Pit River Bridge which carries State Highway across Shasta Dam Lake

ber, with another 10,000 feet used in the approaches.

GOLDEN GATE BRIDGE

The Redwood Highway has its southerly terminus at San Francisco, crossing the historical Golden Gate on the longest single suspension span bridge in the world. This monumental structure across the entrance to San Francisco Bay was constructed by the Golden Gate Bridge and Highway District between 1932 and 1937. The total length of the bridge and approach structure is 8,981 feet, the length of the suspended structure is 6,450 feet, and the length of the main span is 4,200 feet. The towers which support the two 36-inch cables rise 746 feet above the water.

Building the Marin County approach to the Golden Gate Bridge presented some unusual construction problems. This section of the Redwood Highway traverses coastal mountain slopes for the greater portion of the 3.6 miles from Waldo to the bridge. While the terrain is rough and construction involved cuts and fills up to 200 feet in vertical depths, the usual attendant difficulties of such work were increased by the lack of even average mountain stability. The excavation and slides which developed required the moving of more than 2½ million cubic yards of material. The project required a tunnel near the crest with a length of 1,000 feet and a bore 29 feet in height and 46 feet in width. Construction of this four-lane approach to the Golden Gate Bridge cost approximately $2,000,000.

SHASTA DAM RELOCATION

The construction of Shasta Dam, the largest unit of the great Central Valley water and power project required relocation of 19.5 miles of State Route 3 (U. S. 99), as well as many miles of railroad, through rough, forbidding mountainous terrain over which earlier locators did not have the temerity, nor the need, to build.

Here was a situation of concurrent construction almost unique in highway-railroad relations. The more lenient and elastic limitations permitted by the motor vehicle required that the highway bow to the more stringent railroad standards, wherever the two conflicted. In relocation of the two transportation facilities, highway and railroad cross and recross five times, with only one a conventional grade separation structure. Three occur over tunnels deep in the mountain side, and the fifth takes place at the common crossing of the Pit River, where the highway uses the upper deck and the railroad the lower of a $5,000,000 steel bridge.

HEAVY GRADING

The highway portion of this project contains some of the heaviest grading ever undertaken on two-lane construction in Northern California: with a total of 2,850,000 cubic yards of excavation; 726,000 cubic yards in one mile, with cuts up to 275 feet and fills as high as 289 feet.

Notwithstanding more difficult topography, the new route, opened to traffic

on January 8, 1943, is safer, faster, and almost four miles shorter than the old road. Its most outstanding unit is the massive Pit River Bridge, a 3,588-foot, eight-span, double-deck steel structure. This bridge, built by the Bureau of Reclamation which supervised construction of the dam, provides a four-lane crossing for the highway on its upper deck 530 feet above the river bed; and on the lower deck, a double track for the railroad. While two of its massive concrete piers are among the highest in the world, more than 350 feet, they will barely emerge from the high level of the lake which is being formed by the dam.

Dwarfed only by comparison with its bigger sister is the 1,330-foot, seven-span bridge across the Sacramento River at Antler, near the northern end of the new location. This structure, designed and built by the Division of Highways, is interesting because of its complicated design on both vertical and horizontal curves.

FEATHER RIVER HIGHWAY

Carved out of solid rock, hewn through granite cliffs, criss-crossing mountain streams, the Feather River Highway is another thrill for the sight-seeing motorist, as well as a joy and comfort to the Plumas County highlanders. But more than this, the road stands as a monument to the intrepidity of the locating engineer, the skill of contractors and the dogged effort of labor.

The Feather River Highway is the only road over the Sierra that avoids the heavy snow area of the higher altitudes. Throughout most of its length it follows easy river gradients. Such a road has many advantages, but easy construction and low initial cost are not among them. It took more than nine years to build and cost well over $7,000,000, almost $100,000 per mile, and nearly 8,000,000 cubic yards of material, 85 per cent of which was solid rock, were moved in its making.

Natural obstacles to the location of a highway through this rugged country of steep canyon walls and glacier-polished precipices were as formidable as ever confronted the locating engineer. These were complicated by man-made barriers: a transcontinental railroad, powerhouses, transmission lines, and future power reserves. The railroad, built almost 40 years ago, naturally had taken the easiest route, and the highway had to make the best of what was left, leaping across the canyon as the railroad crossed oppositely below or playing hide-and-seek around and over tunnels.



One of many beautiful sections of Redwood Highway (U.S. 101)

THREE TUNNELS BORED

For 10 of the most difficult miles, the road follows a niche cut in the solid wall of the canyon. Three tunnels pierce the most precipitious projections under Arch Rock and through Grizzly Dome, a huge, bowl-shaped mass of bare granite which rises starkly for 1,000 feet above the river.

At Pulga, a 350-foot steel arch joins rocky cliffs of the canyon 200 feet above the river straddling and dwarfing the railroad bridge that crosses at right-angles 170 feet below.

The entire route along the Feather River between Oroville and Quincy is one of natural beauty—pine covered mountain sides punctuated with masses of granite—a section in the California State Highway System which creates an everlasting impression.

SAN FRANCISCO-OAKLAND BAY BRIDGE

The $70,000,000 San Francisco-Oakland Bay Bridge is by far the biggest single project ever undertaken by the Department of Public Works, and rightfully is the most renowned. Spanning 4½ miles of navigable water between the two metropolitan areas, its spectacular construction progressed in

full view of thousands of city dwellers and commuters who gained thereby an appreciation of the immensity of the task. But after eight years even the former "ferry-rail superintendents" who now travel the bridge, secure in fog and storm, seldom recollect that this mighty structure took six years to complete or that it holds many world-wide records, foremost among them: the greatest length, the deepest piers, and the largest vehicular tunnel bore.

The west crossing between San Francisco and Yerba Buena Island, is unique for its twin suspension spans, held by a common anchorage in mid-channel. The wire in the 28¾-inch suspension cables would encircle the earth nearly three times. Its towers reaching as high as 519 feet above water and its piers as much as 242 feet below the surface would overtop a 60-story skyscraper. The 540-foot tunnel through Yerba Buena Island was bored 76 feet wide and 58 feet high to provide for the double-deck construction. The east crossing, between Yerba Buena Island and Oakland, is a steel bridge, the main cantilever span 1,400 feet long. The total length of the bridge from the San Francisco terminal, to the toll plaza at the Oakland end is 8½ miles.

HUGE AMOUNT OF MATERIALS

Building the bridge required materials in quantities rarely encountered in a single structure. Over 152,000 tons of structural steel were erected, 30,000 tons of reinforcing steel was placed and the suspension cables required 18,500 tons of wire; the concrete amounted to 1,000,000 cubic yards which required 1,300,000 barrels of cement; 30,000,000 board feet of timber and lumber were used and it took 200,000 gallons of paint to cover the bridge.

To the construction of the bridge even prehistoric animals contributed their bit—or rather their all—yielding their final resting place to make room for the piers; dredges reached into prehistoric time in excavating for their foundations, pulling a mastodon's tooth and an ancient bison's bones from the ooze 180 feet below the bottom of the bay.

Along with the Golden Gate Bridge, Boulder, Shasta, and Grand Coulee dams, the San Francisco-Oakland Bay Bridge stands out as one of the foremost structures in the west.

SANTA CRUZ LATERAL

Modernization of the scenic route across the redwood covered Santa Cruz Mountains between Los Gatos and the shore line at Santa Cruz has been another undertaking of the first magnitude. The original highway, one of the old "County seat laterals" provided in the State bond issue of 1909, was considered a bold location for its time but, typical of mountain roads of the early days, its tortuous alignment and narrow width became more and more obsolete with the years as traffic speed and volume increased.

Connecting the densely populated San Francisco Bay area with attractions of the Santa Cruz and Monterey coast lines, this is one of the most heavily traveled recreational highways in the State. Those who remember the congestion and dangers on the old two-lane route, when holiday motorists crawled at a snail's pace or risked their lives in passing other cars, can best appreciate the modern four-lane highway through the heavy mountain sections and three lanes through the valleys and flats. Through the heart of the mountains traffic now travels 13 miles of modern alignment with but 42 easy curves instead of 16½ miles of dizzy serpentine of 284 sharp curves, a difference in total curvature equivalent to 36 full circles.

STAGE CONSTRUCTION

The 20.6 miles of new construction (five miles shorter than the old road) progressed by stage construction over a period of 9½ years from 1931 to 1940. It involved 11 road and bridge contracts totaling approximately $3,000,000, one of them the largest grading contract ever undertaken by the Division of Highways—more than 2,500,000 cubic yards in 6½ miles.

One of the unusual features on the Feather River Canyon Highway is the overcrossing by the State Highway Bridge of the Western Pacific Railroad Bridge at Pulga





Snow removal equipment of Division of Highways in operation on Donner Summit

Unusual construction problems in this development and their solution commanded the interest of highway circles throughout the Nation. Treacherous ground conditions and proximity to the San Andreas fault line, which the highway crosses, required rigorous foundation treatment in construction of heavy fills. This work involved such practices as stripping the earth blanket to bedrock and replacing with imported rock base; constructing heavy rock toe-walls for fills; and most extensive trenching and sub-drains. At one section, through narrow Los Gatos Creek Canyon, the highway was squeezed between the steep slope of the mountain and a railroad at the bottom. In this location, two of the four lanes are carried on a reinforced concrete and steel pile sidehill viaduct for a distance of about 1,000 feet.

To thousands of motorists this route provides easy access from the Santa Clara Valley at the southerly end of San Francisco Bay to mountain resorts among the redwoods or on to the beaches at Santa Cruz and its neighboring Capitola, as well as a pleasant way of reaching Carmel and the Monterey Bay area.

CARMEL-SAN SIMEON HIGHWAY

Along the California Coast, the Shoreline Highway offers 450 miles of most beautiful scenery. However, the very topographic features which make the charm of this rugged coast line presented survey parties and construction crews with some of the most dangerous and difficult work ever experienced by Division of Highway forces. From the redwood country of Mendocino County, this route follows the ocean shore, past settlements founded by the Russians early in the nineteenth century, to San Francisco, and on to the south through historic Monterey to one of the Franciscan Fathers' earliest missions in San Luis Obispo.

Much of the present State highway is a relocation of earlier routes which have led a precarious existence, literally "between the devil and the deep, blue sea"—the devil of slides and erosion on one side, and the menace of the ocean's fury on the other. A short portion in San Mateo County was built upon the bed of the abandoned Ocean Shore Railroad; but 68 miles of the southerly portion, from beautiful Carmel to sinister Morro Rock, represent pioneer construction through one of the wildest and most precipitous sections of the entire coast.

COST $9,000,000

This latter portion was 16 years in building (1921-1937) and cost $9,000,000. It required the removal of 13,000,000 cubic yards of material; one massive promontory alone, Limekiln Bluff, yielded 163,000 yards—97,000 in a single blast. The lack of stability of the rock formations of these coastal ridges was a source of much difficulty in the highway's construction. Severe and sudden slides threw tons of material into the ocean at the foot of the bluffs. One such slide carried a contractor's large power shovel with it into the pounding surf.

Thirty-two bridges were required to span the numerous gorges which empty into the ocean along this coastal country, five of them being graceful arches.

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Federal Aid Secondary Roads to be Given Exclusive Attention

By H. B. LA FORGE, Engineer, Federal Secondary Roads

THE Federal-Aid Highway Act of 1944 provides in part for the expenditure of $150,000,000 a year for each of three successive post-war fiscal years for construction upon a system of Federal Aid secondary roads.

It is generally believed that the above act as it relates to an expanded Federal Aid System is of a permanent nature and that Congress will continue to evidence an active interest in secondary roads in the form of regular appropriations. For this reason and because of the increased detail involved, a new section of the Division of Highways has been formed to devote its exclusive attention to this phase of highway work.

GRADUAL DEVELOPMENT

Looking back 25 years we find the foundation being laid for the present Federal Aid System, in the careful selection of our main interstate and intrastate highways. We have seen the gradual development of that system and realize that its component parts were indeed selected with care. This is evidenced by the present vast highway passenger and transport movement which had its beginning in the selection and improvement of the principal traffic arteries.

It is evident that the same care should be exercised in the selection of the Federal Aid Secondary System so that an orderly and progressive program of construction will provide rural areas with proper access to economic and social contacts such as markets and shipping points for farm products, postal service and schools. This secondary system, together with the parent system, are intended to complement each other as trunk line and feeder routes and will, therefore, be interconnected. It necessarily follows that in considering roads for inclusion in the secondary system, no distinction can be made between county roads and roads which are State highways.

There is no fixed maximum for the mileage which may be included in the secondary system, however, the governing Federal regulations require a balance of estimated annual funds available for, against estimated annual cost of, maintenance and construction, of the mileage to be included, so as to permit completion of initial improvement within a reasonable period of years. It is estimated that between 7,000 and 8,000 miles can reasonably be included in the system at this time under this provision. This will provide an abundance of mileage in need of construction even in those counties best equipped with good roads. Time and study will determine what additions can reasonably be added.

Since Federal Aid funds require matching by the recipient, it became apparent that a good many counties would stand to gain no benefits to their county roads because of their inability to provide their share of construction costs. Accordingly, the last session of the State Legislature appropriated $12,000,000 for this purpose under the County Highway Aid Act of 1945. This act also provided that 87½ per cent of the Federal Aid secondary funds be expended upon the county road units of the secondary system as fully as permissible under Federal law, rules and regulations.

NEGOTIATIONS WITH COUNTIES

The District Engineers of the Division of Highways have been instructed to resume negotiations with the counties toward the selection of the secondary system. This work was suspended in December of 1944 due to the uncertainty of pending legislation. After studying the new "Regulations" and the previous work of selection, it is found that the system has been practically agreed upon in about half of the counties. It is hoped that this phase of the work will proceed rapidly so as to clear the way for the next step of establishing a program of proposed construction.

The Federal Aid Act sets up all of the machinery for putting the program into effect except the actual appropriation of funds. Since the funds appropriated by the State Legislature are

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DISTRIBUTION TO COUNTIES

The following tabulation is presented in order to show the distribution of funds as between counties.

Distribution is based on ratio of the average of Rural Population + Area + Mileage Rural Post and Star Routes in a county to similar factors in whole State. San Francisco City and County has been eliminated from consideration. Alpine, Amador, Del Norte, and Sierra counties have been allocated the minimum of ½ of 1 per cent.

	Federal Funds		State funds	Total allocation
	1 year	3 years		
Alameda	$57,022	$171,066	$151,489	$322,555
Alpine	22,585	67,755	60,000	127,755
Amador	22,585	67,755	60,000	127,755
Butte	74,455	223,365	197,801	421,166
Calaveras	27,252	81,756	72,398	154,154
Colusa	30,930	92,790	82,170	174,960
Contra Costa	65,788	197,364	174,776	372,140
Del Norte	22,585	67,755	60,000	127,755
El Dorado	39,098	117,294	103,869	221,163
Fresno	231,221	693,663	614,273	1,307,936
Glenn	36,762	110,286	97,662	207,948
Humboldt	83,921	251,763	222,948	474,711
Imperial	95,114	285,342	252,684	538,026
Inyo	111,949	335,847	297,410	633,257
Kern	202,430	607,290	537,785	1,145,075
Kings	54,144	162,432	143,841	306,273
Lake	30,286	90,858	80,460	171,318
Lassen	67,170	201,510	178,448	379,958
Los Angeles	462,641	1,387,923	1,229,073	2,616,996
Madera	54,939	164,817	145,954	310,771
Marin	41,127	123,381	109,259	232,640
Mariposa	28,659	85,977	76,136	162,113
Mendocino	71,669	215,007	190,401	405,408
Merced	77,470	232,410	205,811	438,221
Modoc	57,372	172,116	152,416	324,532
Mono	40,336	121,008	107,160	228,168
Monterey	90,963	272,889	241,658	514,547
Napa	39,249	117,747	104,270	222,017
Nevada	28,291	84,873	75,159	160,032
Orange	86,608	259,824	230,087	489,911
Placer	46,489	139,467	123,506	262,973
Plumas	44,904	134,712	119,294	254,006
Riverside	166,057	498,171	441,154	939,325
Sacramento	101,006	303,018	268,336	571,354
San Benito	32,412	97,236	86,108	183,344
San Bernardino	302,696	908,088	804,156	1,712,244
San Diego	131,335	394,005	348,911	742,916
San Francisco				
San Joaquin	105,872	317,616	281,264	598,880
San Luis Obispo	71,129	213,387	188,966	402,353
San Mateo	40,783	122,349	108,345	230,694
Santa Barbara	61,057	183,171	162,206	345,377
Santa Clara	103,758	311,274	275,649	586,923
Santa Cruz	36,802	110,406	97,770	208,176
Shasta	73,631	220,893	195,613	416,506
Sierra	22,585	67,755	60,000	127,755
Siskiyou	106,323	318,969	282,462	601,431
Solano	44,757	134,271	118,903	253,174
Sonoma	105,387	316,161	279,975	596,136
Stanislaus	90,990	272,970	241,728	514,698
Sutter	32,813	98,439	87,174	185,613
Tehama	52,901	158,703	140,539	299,242
Trinity	47,598	142,794	126,452	269,246
Tulare	164,452	493,356	436,890	930,246
Tuolumne	39,228	117,684	104,215	221,899
Ventura	71,077	213,231	188,825	402,056
Yolo	39,885	119,655	105,961	225,616
Yuba	26,424	79,272	70,200	149,472
Totals	$4,516,972	$13,550,916	$12,000,000	$25,550,916

Carquinez and Antioch Bridges Became Toll Free on August 1

LESS than five years after their purchase by the State on September 16, 1940, the Carquinez and Antioch bridges have been fully paid for and have become toll-free facilities. Toll collection on both bridges ceased at 12.01 a.m. on August 1, 1945, under a directive of the California Toll Bridge Authority proposed by its chairman, Governor Earl Warren. Under the franchises issued by Contra Costa County for the construction of the bridges, Carquinez Bridge would not have become toll free until March 7, 1948, and Antioch Bridge not until July 4, 1948.

The purchase of the two bridges by the State was financed through a revenue bond issue of $5,943,000. The entire bond issue has now been retired or called for redemption, sufficient revenue having been collected to pay the entire debt and to furnish a small reserve for certain bridge improvements which have had to be postponed as a result of the war.

Coincident with its assumption of operation of the bridges on September 16, 1940, the State established a new toll schedule, reducing the passenger automobile toll from the previous rate of 45 cents for the vehicle plus 5 cents per passenger to a flat charge of 30 cents for the vehicle, including passengers. Other tolls were made to approximate, or to reduce slightly, the previous rates.

Substantial reductions were made in truck tolls on December 16, 1940, and again on May 16, 1941. The continued high volume of traffic made it possible to reduce the passenger automobile toll from 30 cents to 25 cents on June 1, 1942. (See California Highways and Public Works, June, 1942.)

State ownership and operation of the Carquinez and Antioch bridges has resulted in substantial savings to the public using the bridges. Just prior to their acquisition by the State, the average toll on the two bridges was about 65 cents per vehicle. Since September 16, 1940, the average toll has been 37 cents, indicating an average saving of 28 cents per crossing. Applying this figure to the 20,750,000 vehicular crossings which have been made since September 16, 1940, the total saving becomes $5,800,000, which approximates the purchase price of the bridges.

Toll collection expenses and other operating costs have been paid from bridge revenues. Maintenance costs paid from the State Highway Fund during this period have been about $80,000, principally for bridge painting. Franchise and gross revenue taxes totaling about $169,000 have been paid to Contra Costa, Solano, and Sacramento counties. No property taxes on the bridges have been paid by the State to the counties.

Since December 14, 1941, when an emergency was declared by the Governor, the armed forces of the State and of the United States have been benefited by the toll-free passage over these bridges of about 675,000 vehicles.

A further saving to the public could be claimed because of the fact that the bridges have become toll free almost three years ahead of the dates set in the franchises. On the basis of the tolls prevailing just before September 16, 1940, this additional saving would probably be in the neighborhood of $6,000,000.

The elimination of tolls on the Carquinez and Antioch bridges is a concrete fulfillment of the policy of the State of California as expressed in Section 1 of the California Toll Bridge Authority Act.



Antioch Bridge which, with Carquinez Bridge, became toll free on August 1

CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

San Luis Obispo de Tolosa
September 1, 1772

IN the Valley of the Bears, so named by Gaspar de Portola and his men on their first expedition from San Diego north in search of Monterey Bay in 1769, Father Junipero Serra on September 1, 1772, founded the Mission San Luis Obispo de Tolosa, fifth in his chain of Franciscan stations.

Progressing slowly on their march northward, Portola and his soldiers encountered many ferocious bears between the mouth of the Santa Maria River and the present site of San Luis Obispo and killed a number of them for food. Father Juan Crespi, whose ability for picking future mission locations was remarkable, accompanied Portola as did Father Francisco Gomez. Both padres left for posterity interesting diaries describing the trip and the discovery of what now is San Luis Obispo. While the soldiers called the valley there the Valley of the Bears, Fr. Crespi named it La Canada de la Natividad de Nuestra Senora because he arrived there on the eve of the Nativity of the Blessed Virgin, September 7, 1769.

As we know, Portola failed to find Monterey Bay and returned to San Diego discouraged and determined to return to Mexico. However, he was spurred on to make another attempt by Fr. Serra and set out again from San Diego on April 17, 1770, while Fr. Serra, Presidente of the California Missions, went with a sea expedition which anchored in Monterey Bay shortly after Portola reached there by land.

BEAR MEAT

Ten Franciscan friars arrived at Monterey from Mexico on May 21, 1771, but lack of food supplies at Monterey and San Diego delayed the founding of Mission San Luis Obispo. Indeed, while awaiting ships and supplies from Mexico, Captain Pedro Fages with some of his men returned to the Valley of the Bears on a hunting trip and sent back to Monterey and Mission San Antonio 9,000 pounds of bear meat.

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into northern Washington.

Present day State highways lead to all the mission sites. When the war is ended and California again welcomes tourists from all over the world and there are no longer restrictions on automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways will publish in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions will be taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the sixth of the series.

The ships with food reached San Diego in August, 1772, and landed with their cargoes there for transportation north. So Fr. Serra set out for San Diego with Fages, determined to found Mission San Luis Obispo on his way south.

Those familiar with the thriving city of San Luis Obispo of today, where is situated the mission of that name, may be interested in the description of the site as recorded by Fr. Francisco Palou, biographer of Fr. Serra. Speaking of the expedition of Fages and the establishment of the mission, Fr. Palou wrote:

"Thus in time the company arrived in the vicinity of Bear Valley. After surveying the locality, it was determined to found the mission about half a league before reaching the Canada de los Osos, yet in sight of it, on a level plot, which to all appeared most suitable for the mission on account of two little arroyos which contained water with sufficient lands that with but little trouble could be irrigated from them. For the site of the mission a slight elevation below which ran the two arroyos was designated. The Cross was constructed and immediately an arbor (enramada) was erected for the chapel. After the blessing and the sacred ceremonies * * * the standard of our Redemption was planted and venerated. On September first of said year 1772, the Rev. Father Presidente Serra celebrated the first holy mass on an altar, which had been prepared in the arbor, and thus the beginning was made of the Mission dedicated in honor of San Luis Obispo de Tolosa."

PADRES HARDY SOULS

The padres of those early mission days were enured to privations but it would seem that Fr. Jose Cavaller, left at San Luis Obispo by Fr. Serra when he resumed his journey to San Diego, must have been endowed with superhuman ability to sustain himself and his assistants on scant rations for Fr. Palou records that:

"As a guard for said mission, Captain Fages left two leather-jacket soldiers and three Catalonian Volunteers. In addition, the Fr. Presidente assigned two Lower California neophytes in order that they might begin to build the dwelling and chapel. For the maintenance of the missionary



This is Mission San Luis Obispo de Tolosa as it looks today

Father, the five soldiers and the two Indians, the captain left there 50 pounds of flour, three pecks of wheat for sowing, a quantity of chocolate, and a box of brown sugar for which latter they might obtain wild seed from the gentiles (Indians)."

Just what Fr. Cavaller would have done had the natives proved hostile is problematical, but it so happened that the Indians were grateful to Captain Fages and his soldiers for having slain so many savage bears that frequently attacked and killed them and they came in numbers to the embryo mission bringing venison and wild seeds which furnished sustenance for the little band.

FATHER SERRA PLEASED

The first year was a hard one for Fr. Cavaller. Three times the mission suffered from fire, the first blaze being started by a disgruntled Indian who fired a blazing arrow into the grass roof of the mission building. The origin of the other two fires was not known. However, they proved of benefit because the mission fathers contrived to find a way to make tiles with which they roofed their structures and all other missions did likewise.

Fr. Serra stopped at San Luis Obispo in May, 1774, on his way from Mexico to Monterey and expressed himself delighted with the progress made. He, himself, baptized six Indians. By the end of 1774 about 107 Indians had been baptized and 28 marriages blessed.

On March 1, 1776, Lieutenant Colonel Juan Bautista Anza and his expedition stopped at the mission on their second trip from Sonora, Mexico, to San Francisco and Fr. Pedro Font of Mission San Joseph de Los Pimas, Sonora, left behind him an interesting and accurate account of Anza's journey and the visit to San Luis Obispo.

"The Indians of this mission," Fr. Font wrote on his visit to San Luis Obispo, "are clean, tidy and better looking and handsomer than those of any other tribes so far as I have seen."

FAREWELL TO FATHER SERRA

Fr. Serra visited San Luis Obispo again on November 28, 1778, and confirmed 53 neophytes. Again in March 1782, the Fr. Presidente of the Missions appeared at the mission and confirmed 79 neophytes. He was en route south and in May on his way back to Monterey he paid another visit. On November 29, 1783, he came to say farewell to the padres realizing that his advancing years would make any future journey to his beloved stations impossible.

Though Mission San Luis Obispo was one of the smallest of the missions, it nevertheless contributed its share of an assessment levied against the California Franciscans in 1782 by the King of Spain to help him carry on his war against England. It sent $107 to Spain.

From 1794 to 1809 building operations at San Luis Obispo were quite extensive. In 1804 the mission had its greatest number of neophytes, 832, and by the end of that year the records showed a total of 2,074 baptisms and 1,091 deaths. In May, 1807, the mission was designated as one of six missions in which the California padres

could make their annual retreats for spiritual exercises.

Beginning in 1811 and continuing through 1820, the missionary fathers caused to be erected numerous dwellings for their Indians, made many improvements and additions to the mission and in 1819 finished constructing the quadrangle of the mission. A year later the two mission bells arrived from Lima Peru.

MILITARY DEMANDS

Following Mexico's revolt against Spain in 1810, Mission San Luis Obispo was compelled, as were all the California missions, to contribute food and clothing to the army, which the government ceased to support. Fr. Luis Martinez at San Luis Obispo many times found himself and his Indian wards suffering privations because of the constant demands of the military.

Fr. Martinez was a jovial soul and his wit and good humor won him widespread fame in those early days. His sarcastic comments on the idleness of the soldiers got him into trouble with Governor Sola in 1816, but two years later he won the good graces of the army when he valiantly led a company of his Indians to Santa Barbara and San Juan Capistrano, many leagues distant, to help defend the missions against two shiploads of South American privateers who had landed at Monterey and engaged in looting and then sailed south to Santa Barbara and San Juan Capistrano. Governor Sola so far forgot his animosity toward Fr. Martinez as to recommend him highly too Viceroy Venadito. Fr. Martinez even contributed clothing to ragged soldiers without a demand being made upon him.

It seems a pity that he could not have finished out his missionary days under the happy circumstances that surrounded him at this time, the year 1822. But tragedy for Fr. Martinez lay just ahead.

TRAGEDY OF FR. MARTINEZ

Repeated offenses by soldiers at the mission forced Fr. Martinez to complain bitterly to the Governor. Finally, in January, 1825, abuses heaped upon the padre by insolent soldiers caused Fr. Martinez to close the doors of the church to them and later to apply for a passport to leave the country. One Vicente Cane falsely reported to Governor Jose de Echeandia, enemy of the missions, that Fr. Martinez, contemplating flight, had shipped $6,000 of mission money to Mexico. The story, as old records show, had no foundation of fact, yet it was the beginning of the end for Fr. Martinez.



Ancient doorway of Mission San Luis Obispo

Soldiers at the presidio of Monterey revolted in November, 1829, imprisoned their officers and then, with Joaquin Solis, their leader, marched on Santa Barbara, where they were repulsed. Echeandia seized upon this incident to accuse Fr. Martinez of having aided Solis and on February 3, 1830, ordered the arrest of the padre on charges of treason.

Fr. Martinez was forcibly seized at San Luis Obispo and taken to the Mission Santa Barbara where he was held incommunicado. A farcical trial was held, perjured testimony taken and Fr. Martinez was ordered banished by Echeandia. The grief stricken friar sailed for Peru on March 20, 1830, at the age of sixty-four and after having served thirty-four years at the mission. Fr. Jose Joaquin Jimeno was sent from Mission San Luis Rey to San Luis Obispo.

MISSION IMPOVERISHED

Illness was decimating the ranks of the Indians at San Luis Obispo at an alarming rate and the military and civil authorities and settlers were rapidly ruining the mission by impoverishing it. Conditions at San Luis Obispo

were more deplorable than at any other mission at this time. Designing politicos furnished the Indians with liquor and disorders were frequent.

In October, 1835, Manuel Jimeno Casarin was named civil commissioner to take over the mission and its property. An inventory placed the value of the mission and its possessions at $70,769. Fr. Ramon Abella remained on in the hope he could do something for his Indians. In February, 1840, he sadly reported that he did not even have candles for his church.

Eugene Duflot de Mofras, noted French writer, visited San Luis Obispo in 1841 and wrote among other things: "In the Mission building, which is now in ruin, we found reduced to a state of greatest want, the oldest Spanish Franciscan of California, the Rev. Fr. Ramon Abella. The Mission has suffered such devastations that the poor friar was bedded on an ox-hide, and used the horn of an ox as a drinking cup, and for nourishment had only strips of meat dried in the sun."

The story of the ruin of San Luis Obispo under successive Mexican governors is similar to that of the other missions in California, as related in preceding chapters. On December 4, 1845, Governor Pio Pico sold Mission San Luis Obispo to Scott, Wilson and McKinley for $500.

AMERICAN OCCUPATION

Then came American occupation of California. On September 2, 1859, President James Buchanan returned Mission San Luis Obispo and its lands to the Catholic church.

In 1857, Don Dolores Herrera, a Spanish American, whose eldest daughter had been educated at St. Vincent's College, Santa Barbara, and who was teaching school in San Luis Obispo, deeded to Right Rev. Thaddeus Amat, Bishop of Monterey and Los Angeles, a block of land in the rear of the old Mission to be used for the erection of a convent school. Herrara desired that his five other daughters be educated there.

Finally, in 1876, the convent was completed and eight sisters of the Immaculate Heart of Mary arrived there to take charge. The school was opened August 16, 1876. A new parochial and grammar school was added to the convent in 1926. A fire razed the convent in 1930. The new school was named "The Mission High" in honor of the old padres.

Mission San Luis Obispo has been restored and its priceless ancient paintings and relics are treasures worth seeing.

Visitors to Mission San Luis Obispo, in the city of that name, if coming from the south, follow the Coast Highway, U. S. 101, direct to San Luis Obispo. If a stop has been made at Mission La Purisima Concepcion, the route is from Lompoc north over State Route 56 to its junction with the Coast Highway just south of Orcutt, thence through Los Alamos, Santa Maria, Nopomo and Arroyo Grande to San Luis Obispo.

Coming from the north, mission visitors will motor direct from San Francisco over the Coast Highway to San Luis Obispo or they may come down the San Joaquin Valley, U. S. 99, turn west at Famoso on State Route 33 to Paso Robles and then south to San Luis Obispo.

San Antonio de Padua
July 14, 1771

LONELY outpost of the Franciscan stations established by Fr. Junipero Serra, Mission San Antonio de Padua was founded far off what later became El Camino Real, "The King's Highway," by the Presidente of the California Missions on July 14, 1771. It was the third of Junipero's missions, now twelfth on the Trail of the Padres.

Situated in a pleasant oak-covered valley in the Santa Lucia Mountains, the site chosen by Fr. Serra was a spot where Gaspar de Portola and his expeditionary force had camped in September, 1769, on their way from San Diego in search of Monterey Bay.

In those first years of his missionary undertakings, the zeal of Fr. Serra knew no bounds, so that, having founded Mission San Carlos Borromeo at what now is Carmel, he set out from Monterey with a squad of soldiers, some lower California neophytes and Fathers Miguel Pieras and Buenaventura Sitjar to locate a suitable place for his third mission.

BELLS RING OUT

Fr. Zephyrin Engelhardt, mission historian, relates that Junipero and his little party stopped close by a river which Fr. Serra promptly named San Antonio and had his goods unpacked. The bells brought along were suspended from a live oak tree. The sight of them, says Fr. Engelhardt, aroused Fr. Serra's enthusiasm and he ran up to them, grasped the cords and rang them in a lively manner. Then he shouted:

"Hear, Oh Gentiles! Come! Oh come to the holy Church of God! Come, Oh come, and receive the Faith of Christ!"

In amazement, Fr. Pieras cried out: "Why, Father, do you tire yourself? This is not the spot on which the church is to stand, nor is there within hearing a single pagan soul. It is useless to ring the bells."

To which Fr. Serra replied: "O Father Miguel, let me give vent to my heart's desires; for I would that these bells were heard all over the world, or at least by all pagan people who live in this sierra."

The venerable padre's wish was fulfilled, at least in part, for a lone Indian, attracted by the sound of the bells, cautiously approached while Fr. Serra and his colleagues, having constructed, raised and blessed a large cross, were celebrating holy mass within a brushwood shelter wherein an altar had been placed. This on July 14, 1770, in honor of San Antonio, patron of the new mission, on the day dedicated to the seraphic Doctor, St. Buenaventura.

Observing the hesitant savage, Fr. Serra was filled with joy and in his sermon said: "I trust in God and in the favor of San Antonio that this mission will became a great settlement of many Christians, because we see here what has not been observed in any of the other missions founded hitherto, that at the first holy Mass the first fruit from paganism has been present. He will surely not fail to communicate to his tribesmen what he has seen."

INDIANS BEAR GIFTS

And, indeed, the lone Indian did not fail. Presented with colored glass beads, he hastened to his concealed fellows and soon many Indians came with gifts of wild seeds and acorns. They accepted the missionaries with great faith and confidence, so that 15 days later Fr. Serra set forth highly pleased for Monterey, leaving Fathers Sitjar and Pieras to build with the aid of the soldiers and the friendly natives the Mission San Antonio de Padua.

At the sacrifice of space which could be devoted to details of the demoralization of Mission San Antonio under Mexican rule decades later, but which details would be a repetition of the



Mission San Antonio de Padua in the early days of its decay

mission stories preceding this one, it may be worth while here to relate a strange tale recounted by Fr. Palou, biographer of Fr. Serra. Fr. Palou wrote in 1773:

"Among the Indians baptised at San Antonio was a woman whom they named Agueda, so old, that to all appearance she must have been 100 years of age. She came to the Fathers and asked for baptism.

"When they questioned her why she wanted to be a Christian, she replied that when she was very young, she heard her parents tell of the coming to that country of a man who was vested in the same habit that the missionaries wore. This man had not entered the land on foot but came flying; and that he told them the same that the missionaries were now preaching; and that remembering this she was moved to become a Christian. Not putting any credit in what the old woman related, the Fathers sought information on the subject from the neophytes. They all unanimously replied that thus they had heard it said from their ancestors, and that this tradition was general and handed down from parents to children.

STRANGE TALE

"When I heard this story from the Fathers," continues Fr. Palou, "I immediately remembered the letter which in the year 1631 the venerable Mother, Sister Mary of Jesus de Argreda, wrote to the missionaries engaged in the spiritual conquest of New Mexico, in which letter, among other things, she told them that our Father St. Francis brought to these nations of the North two Religious of his order to preach the faith of Jesus Christ (which missionaries were not Spaniards) and that after affecting many conversions, they suffered martyrdom. After computing the time of their visits, I judged that perhaps it might have been one of these Religious of whom the neophyte Agueda spoke."

There is Fr. Palou's story and it would appear that with the Indians of San Antonio more than a century and a half ago there passed an interesting bit of California history that never can be checked.

"The fact," says Fr. Engelhardt, "that the Indians of San Antonio Mission district manifested such eagerness to learn more about Christianity, and their extraordinary willingness to help the missionaries in every way, lends a good deal of plausibility to the story of the woman and of her people."

SAN ANTONIO GROWS

Surrounded by friendly Indians, San Antonio grew apace and before his death Fr. Serra, in 1784, had the pleasure of counting 1,804 neophytes at this mission, realization of the hope he had expressed in his sermon on the day of its founding that there would be a large settlement of Christians there with the aid of God and San Antonio.

Four months after the founding of the mission, Captain Pedro Fages, who did not approve of the missionaries, took away from San Antonio the military guard. Fr. Serra decided to go to Mexico and personally lay before Viceroy Antonio Maria Bucareli a protest against the growing opposition to his work on the part of Fages. The Viceroy sent word to California that military interference must cease.

The padres at San Antonio pushed building operations from the start. During the year 1776 the church was roofed with mortar and tiles and a street lined with adobe dwellings for the Indians was completed. Storerooms, barracks, warehouses and shops were erected and irrigation ditches to carry water to the field from San Antonio River were dug. In 1779 a building 133 feet long for the church and sacristy was started and finished the following year. Old records reveal steady progress in building through the years. In 1813 the new church was completed and long before that a water power mill had been erected. The Indian community grew steadily. Wells were dug, a reservoir and aqueduct built. Heavy rains fell in San Antonio district in 1825, causing the collapse of a number of structures, but these were replaced by larger and stronger buildings.

With the arrival in 1825 of Governor Echeandia trouble began for San Antonio as it did with the other missions. While other missions were stagnating under political rule in 1827, Fathers Juan Bautista Sancho and Pedro Cabot continued building at San An-



All that remains of Mission San Antonio de Padua is shown in this recent photograph

tonio against heavy odds. The last official report from the mission was written by Father Cabot December 31, 1832.

TROUBLE BEGINS

Through successive Mexican administrations, San Antonio struggled along, burdened by excessive demands for food, clothing and money made and enforced by the military. The politicos made haste to seize the property of San Antonio and on November 12, 1834, Manual Crespo arrived there as commissioner. Disorders followed, the Indians became addicted to liquor furnished by unscrupulous politicos and many scattered to their haunts in the mountains. Governor Figueroa finally was compelled to discharge Crespo and Jose M. Ramirez succeeded him.

In December 31, 1835, Fr. Mercado, reporting on conditions at the once happy and prosperous Mission San Antonio wrote: "So numerous are the Indians who wander about as fugitives or as vagabonds that one can not prudently make an estimate." Only a few years before, these natives had been happy and industrious under the regime of the padres.

Thousands of head of cattle, sheep and horses had disappeared and the fields were uncultivated. In May, 1845, when Governor Pio Pico ordered the sale of the missions, San Antonio had been looted to such an extent that no one would bid for it. The following year came American occupation and Pico's expulsion. Mission San Antonio was restored to the Catholic Church by President Lincoln on May 31, 1862.

MISSION DESERTED

Reverend Doroteo Ambris, the last resident priest at Mission San Antonio, served there from February 29, 1846, to May 5, 1882. After his death, the mission was deserted and vandals and settlers gradually dismantled it, taking away the tiles on the roofs of the buildings and finally stealing timbers from the various structures. Patriotic citizens in San Francisco became incensed at this wanton destruction and in 1903, led by Joseph R. Knowland of Oakland, then State Senator and later Congressman, organized the California Historic Landmarks League. As president of the league and also head of the Native Sons of the Golden West, Knowland traveled throughout the State urging the raising of a Restoration Fund.

Reporting to the Grand Parlor of the Native Sons in 1903, the Historic Landmarks Committee wrote:

"Mission San Antonio de Padua, in Monterey county, is in a deplorable state of ruin. The roof of the once imposing chapel has fallen, and the walls of adobe, now unprotected, are year by year being leveled by the merciless elements. The beautiful arches are becoming ruined heaps, and the valuable tiles are disappearing. No Californian can view these picturesque ruins, covering several acres, and fail to become an enthusiastic advocate of mission restoration."

On June 19, 1904, the Historic Landmarks League held a meeting at San Antonio attended by church dignitaries and many persons interested in restoring the old mission. Fr. Zephyrin Engelhardt of Santa Barbara Mission was the celebrant of the holy Mass. He was the first Franciscan to celebrate holy Mass on the spot since the departure of the last resident Franciscan padre sixty years before.

With contributions raised by the Native Sons and Native Daughters restoration work was started, but had to be discontinued owing to lack of

(Continued on page 29)

Bridge Maintenance Practice On California Highway System

By M. A. EWING, Associate Bridge Engineer

THERE are 4,636 bridges on the California State Highway System omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is $12,500,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenance and Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the fifth. It deals with Scour and Settlement Problems.

SCOUR of streambed, to greater depth than anticipated in design, presents difficult maintenance problems, and resulting damage varies from loss of supporting material to complete loss of the structure. The major failures are infrequent and each must be considered as a separate problem; methods of correction can not be generalized in a short article. Where the entire structure has been lost, it becomes a problem for the design and construction departments, however, structure settlement, resulting from stream scour, occurs almost every season and it is the problems connected with the correction or prevention of this condition that will be outlined in this article.

When designing repairs for a structure that has been damaged by scour, the first requirement, of course, is to restore it to a usable condition for traffic. The next question is whether additional safeguards against future scour are required, and, if so, to what extent. In most instances, the work necessary to restore the structure to a usable condition provides all the safeguards needed. Where additional protection is desirable because of a change in local conditions or deficiency in the original design, the extent of the work should be governed by the same factors of economy as would be applied to the bridge as a whole, such as the remaining service life, probable frequency of recurrence of the scour condition, etc.

These factors are difficult to evaluate in the limited time usually available but it is important to keep them in mind as there is a natural tendency toward overdesign of the protection work when confronted with the emergency of a badly damaged structure.

GENERAL SCOUR ANTICIPATED

General scour, occurring over long distances of the streambed and continuing from year to year, is typical of mountain locations and does little damage to State Highway bridges. The condition is anticipated, the rate of scour estimated at the time of the original design, and the protection constructed accordingly.

An example of a troublesome condition occasionally encountered in mountain locations where the foundation material consists of boulders, is the loss of fines and small rock from between the boulders, leaving the footings supported at comparatively few points. The correction of this condition is difficult and expensive where there is water to fight, and satisfactory results are not easily obtained. Concrete is needed to fill the voids between the large boulders but the stream velocity is usually high and in the boulder and gravel formation the water can not be sealed off effectively.

Although the working area can not be dried up, the water can be stilled by means of a sacked concrete wall around the footing, and the voids in the foundation filled with concrete by pumping. The discharge pipe from the pump should be manipulated in somewhat the same manner as a tremie tube. The quality of the concrete so placed is questionable but if care is used, the strength will be adequate for ordinary footing pressures.

On one repair job an effort was made to work grout and small rock, together with sacked concrete, into the voids under the footing while deflecting the current with sacked concrete. The grouting was not successful but most of the voids were filled with the rock and sacked concrete. Where the work can be done in the dry, formed concrete is most satisfactory. Heavy rock riprap is usually available for protection work in mountain locations.

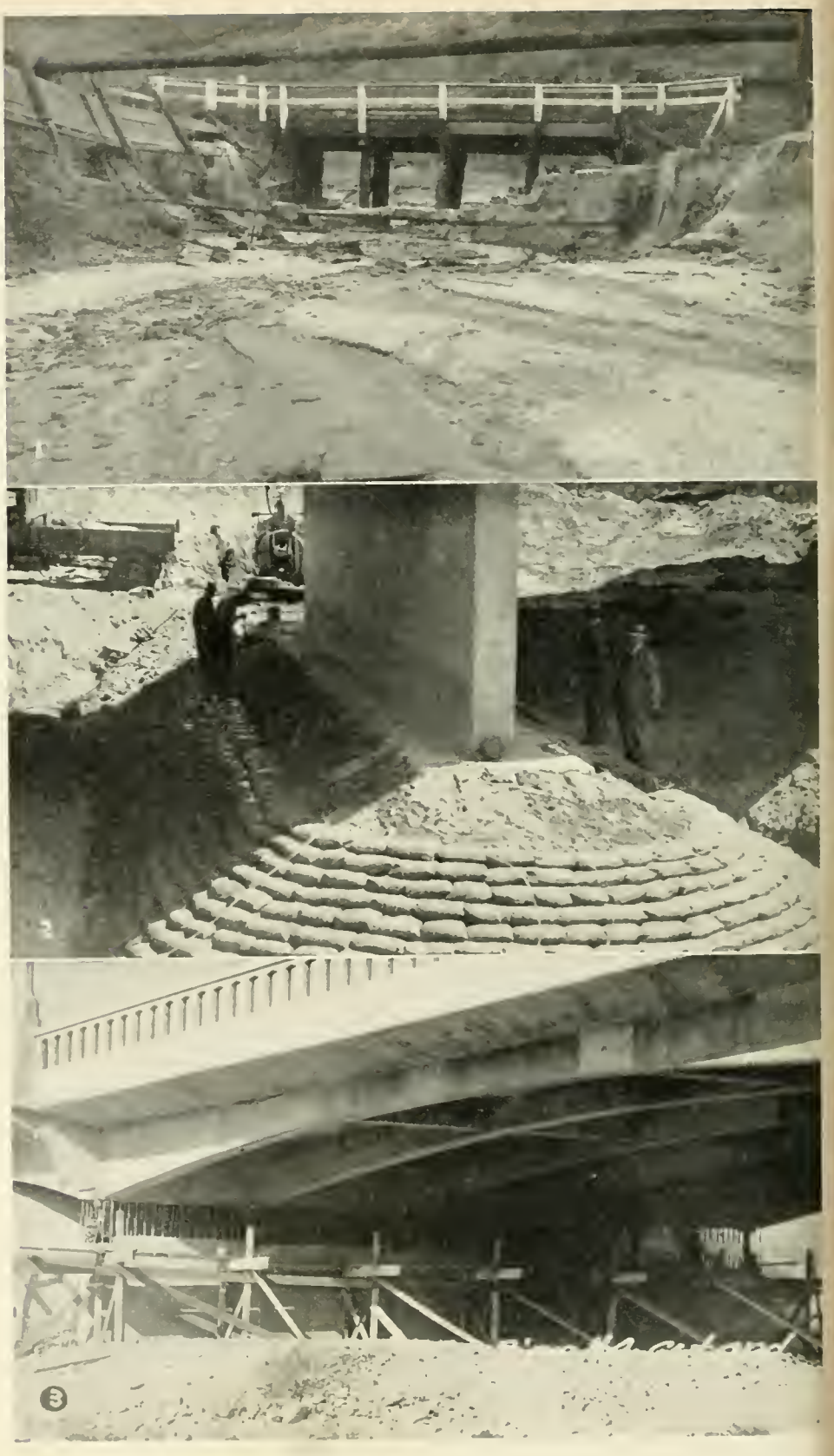
FOOTING DEPTHS WATCHED

Streams in foothill locations and those on alluvial fans may be either scouring or filling and it is possible to have both conditions during the life of a bridge. It is here that footing depths may be inadequate and must be watched. Such a scouring stream is shown in **Picture No. 1** where the streambed lowered about six feet in one season. This stream joins a larger one about one mile below, and the recession was caused by scour in the main stream. It was necessary to reconstruct two of the bents but since the bridge is scheduled for replacement soon no protection work was done.

When the value of the structure is such that additional protection is required there are two general procedures to be considered. One is to restore the streambed to its original elevation by some means such as a check dam, and the other is to confine the protection work to the bridge itself, leaving the streambed free to fluctuate. Both methods were considered in the case of the bridge across South Branch of Big Tujunga Wash on Foothill Boulevard in Los Angeles County.

This is a modern continuous girder structure which was damaged by

Upper — Granite Canyon, Route 142, Kern County. Scour of 6 feet in one season. Center—South Branch of Big Tujunga Wash, Route 9, Los Angeles County. Sacked concrete riprap under construction. Lower — South Branch of Big Tujunga Wash, Route 9, Los Angeles County. Jacking the superstructure back to grade



stream scour in 1938. Two of the piers settled, once as much as nine inches, and the streambed lowered about six feet, leaving insufficient footing depth to withstand future scour.

SACKED CONCRETE RIPRAP

A proposal for a check dam extending entirely across the channel at the downstream end of piers with a height sufficient to restore the streambed, was abandoned in favor of sacked concrete riprap extending six feet below footing at each pier. **(Picture No. 2.)** In constructing this type of protection, care should be used in excavating, in order to prevent loss of ground from under the footing and consequent settlement of the pier, and the time of construction should be chosen carefully as a flash flood would be disastrous. Obviously this type of repair can not be used in running water. In this case, sheet piles would provide a permanent repair if the type of soil and driving clearances permit. Otherwise, rock riprap will have to serve. At the end pier of this bridge it was necessary to cut the top of pier and jack the superstructure back to grade. This is shown in **Picture No. 3.**

Other examples of inadequate footing depth are common throughout the State, particularly among the older structures. Probably constructed during a filling phase of the stream, the footings have since been exposed by a scouring phase. As mentioned before, this condition is more common in foothill locations but may occur in the valleys as well. Cut-off walls of sacked or formed concrete constructed to a depth below any probable future scour provide a permanent repair. Formed concrete is necessary in many cases where load-bearing capacity is required, as well as protection for the remaining foundation material, but sacked concrete is preferred and is used whenever possible, as it can be extended if necessary and can be patched in case of damage.

KINGS RIVER BRIDGE

Picture No. 4 shows an abutment of the Kings River Bridge, VI-Kin-125-E, where it was necessary to construct a small buttress fill as well as a sacked concrete cut-off. This is a valley location and was caused by a local shift of the stream. The foundation material was considered capable of supporting the vertical loads and the buttress fill was intended to take the horizontal pressure from the base

Upper—North Fork of Kings River, Route 125, Kings County. Buttress fill riprapped with sacked concrete. Center—Poso Creek, Route 4, Kern County. Bent No. 4, damaged by scour and settlement, at start of repair operations. Lower—Poso Creek, Route 4, Kern County. General view showing damage from scour







of the abutment. Grout can be pumped into the area under the footing to stabilize the foundation material if necessary. This is usually done after the riprap or cut-off walls are completed.

The foundation material, under the center pier of the South Fork Eel River Bridge on the Redwood Highway, was consolidated with grout after a heavy rock blanket had been placed around the footing. This pier which supports two 120-foot steel deck girder spans, designed continuous over the support, had settled 1.2 feet and tipped almost a foot at the top. The footing was 31 feet by 15 feet in plan and the downstream portion was undermined to a depth of several feet.

This was caused by a general lowering of the streambed during a period of abnormal high water. The pier shaft was hollow and holes were drilled and grout pumped through the footing from inside the pier. Twenty-three holes were drilled and 552 sacks of cement were used in this pressure grouting repair.

LOCAL SCOUR

The major portion of scour damage occurs under conditions that might be classed as local scour. Even a stream that is normally filling may scour to considerable depth because of a change in local conditions, such as the construction of a fence, growth of trees and brush, the accumulation of trash, or the reverse, such as cleaning the channel or the construction of control works nearby. There are many contributing factors and the majority are unpredictable. Such damage is pure maintenance and very little expense for additional protection can be justified.

The bent settlement at Poso Creek Bridge near Famoso, illustrates a repair where additional protection was not justified. This scour was caused by a combination of extreme high water, large square columns obstructing the channel, and cross currents which may have been caused by the lack of skew in the railroad bridge about 200 yards upstream.

The streambed is sand to considerable depth and scoured easily. Three

of the bents settled varying amounts, the maximum being more than five feet. The maximum differential settlement between the individual spread footings of one bent was about four feet. In designing the repairs it was considered that the original footing depth was adequate for the design flood, it was impractical to streamline the piers, and that no additional precautions should be taken to protect the structure from an exceptional flood such as that which caused the damage. Accordingly, two of the bents which had suffered no structural damage were reused; the deck being jacked back to grade and supported on concrete pads. The cap of the other bent was damaged because of differential settlement and the columns were out of plumb **(Picture No. 5)**.

In plumbing the columns the footings were lowered somewhat, the two upstream columns being lowered as a unit, the other separately, and a new cap constructed. Final footing elevation for the two upstream columns was about six feet below original elevation. Five feet of this represented settlement, the other foot being gained in the plumbing operation. The original rigid concrete slope paving was damaged severely **(Picture No. 6)** and was replaced with sacked concrete riprap.

EXAMPLES OF SCOUR CONTROL

Examples of scour control and training works are shown in **(Pictures No. 7 and No. 8)**, where the channel downstream from the bridges lowered as much as seven feet with scour holes nine feet deep. The timber cut-off wall **(Picture No. 7)** was placed under emergency conditions and is of temporary construction. The drop structure **(Picture No. 8)** is a permanent type and provides training walls for turning the stream. The invert slab of these structures acts as a check dam and the scour is controlled by rock riprap in one case and the concrete drop structure in the other. No other general correction procedure could be considered since the invert slabs are an integral part of the bridges. The scour is attributed to the "brushing out" of the channel downstream from the highway and to control works upstream. The normal bed load of the stream was removed at the control works and thus disturbed the balance between scouring and filling.

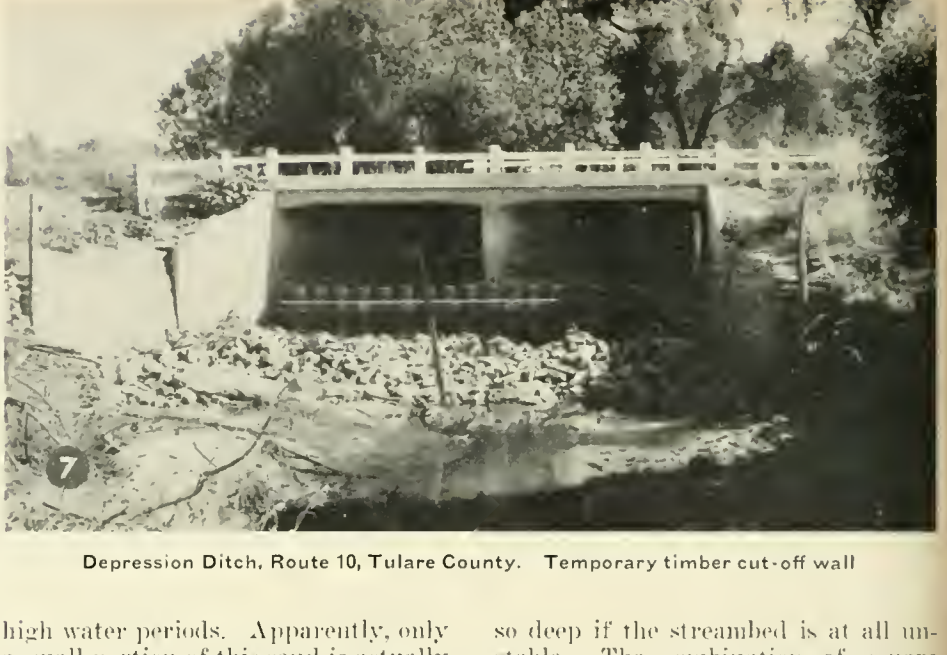
SAND PROBLEMS

The sand in sand channels is disturbed at considerable depth during high water periods. Apparently, only a small portion of this sand is actually moved downstream and this is replaced as the stream recedes. At Goose Lake Slough in Kern County it was reported that soundings during the highwater of 1943 found bottom about 12 feet below normal streambed. Concrete columns with spread footings, used previously for pile replacement at this location, were lost. In repairing the flood damage a new pile bent was driven since the depth required to be safely below the turbulent sand was too great for spread footings.

Much scour and settlement is caused by the obstruction of the pier itself. Even with normal flow the roller at the upstream end of a square ended pier will scour out a pothole a foot or so deep if the streambed is at all unstable. The combination of square ended piers and the increased velocity of flood flows will damage the foundations even when quite deep.

The upstream end of a pier usually settles more than the downstream end, because of the additional scour caused by this roller. This twists and damages the superstructure of the bridge and complicates the repair work. The piers of major structures are usually streamlined but this has been neglected on small structures and culverts. A rounded or pointed nose on any pier will reduce the amount of differential settlement, if the pier should be undermined, and can be provided at very little additional cost if included in the original design. Such protection has

(Continued on page 28)



Depression Ditch, Route 10, Tulare County. Temporary timber cut-off wall

Outside Creek, Route 10, Tulare County. Concrete drop structure

War Time Highway Construction in District V Aggregated $9,500,000

By L. H. GIBSON, District Engineer

ESTABLISHMENT of four major army camps and one large training area prior to Pearl Harbor in the coastal counties of Monterey, San Luis Obispo and Santa Barbara, in District V, required that immediate steps be taken to provide adequate access roads for the anticipated abnormal traffic volumes and military needs.

Recognizing that adequate access roads were an essential part of the military establishments, commanding officers initiated a series of conferences starting in December, 1940, at which systems of access roads deemed necessary for each of the various establishments were designated. Expeditious approval of preliminary surveys and estimates by the Public Roads Administration permitted undertaking surveys shortly after the conferences. This made it possible for two projects to be undertaken by the Works Projects Administration early in 1941 prior to the time funds became available under the Defense Highway Act of 1941.

110 MILES OF ACCESS ROADS

Although a total of nearly 140 miles of surveys were made by this district during the entire access program, the final construction was reduced to 110 miles, of which 48 miles were on State highways and 62 miles on county roads. With surveys and plans on the original 140 miles of highways to be completed in as short a time as possible, the problem of obtaining sufficient experienced personnel became acute. Extensive military construction and expanding war industries and military services had practically exhausted the supply of engineers, making it necessary to borrow personnel from districts having less urgent work, employ and train inexperienced personnel on the job and to work the personnel overtime.

Construction of the 110 miles of access roads, all under the supervision of the Division of Highways, was completed between April, 1941, and June, 1944, at a cost of $8,400,000 under 22 contracts, two day labor, and two Work Projects Administration projects. The access road program varied in scope from grading and paving four-lane divided highways to widening and resurfacing existing highways which were distressed by the unusual heavy military traffic.

LARGE CONSTRUCTION PROGRAM

In addition to this large access road program, one major project deemed essential to national defense and 11 resurfacing projects have been constructed by this district since Pearl Harbor. These projects involved developing three miles of existing two-lane highway into a four-lane divided highway north of Salinas and repairing 91 miles of existing highways by reinforcing and resurfacing at a total cost of $1,120,000.

This large construction program was completed in a comparatively short period in spite of the impediments induced by the expanding war industries and military construction which carried higher priorities than the highway construction.

Shortages of labor, materials and equipment and repair parts were major obstacles to be contended with and in some instances it was necessary to canvass labor from distant points and furnish daily transportation or living accommodations. Delays due to equipment breakdowns became a matter of days in place of hours. Preclusion of the use of some material by regulations promulgated subsequent to letting of contracts and depletion of the supply of others required modifications of contracts in many instances to provide for the use of best available substitutes. Congestion of railroad facilities and the shortage of railroad equipment added to the difficulty of obtaining materials.

VALUABLE IN PEACE TIME

Though the access roads were constructed primarily to serve pressing military needs, they will also be of value to public traffic, particularly on return of normal travel after termination of the current conflict. Improvement of the substandard secondary highways by relocation and reconstruction between Seaside near Monterey, and the Coast Highway (U. S. 101) near Prunedale, provides a shorter and less congested route than that previously used through Salinas for traffic between the San Francisco metropolitan area and the popular Monterey Peninsula recreational area.

Replacement of the little improved original El Camino Real between Bradley and King City via Jolon with an all-weather modern highway provides easier access to the extensive Jolon farming area and lends to development of the rugged wilds of the Santa Lucia Range in the Los Padres National Forest for recreational purposes.

Need of a more direct route between the rich agricultural areas of Lompoc and the Santa Maria Valley, in Santa Barbara County, had been recognized for some time. A portion of the route between the Santa Ynez River and San Antonio Creek was constructed as a feeder road project in 1939, but funds had not as yet become available to complete the projected route. With the establishment of Camp Cooke, the section between the San Antonio Creek and Casmalia was built as a part of the camp construction to serve as an interior camp road and provide an outlet from the camp to the north. Replacement of the existing circuitous substandard county roads by construction of a modern highway as an access road between Casmalia and Santa Maria completed a modern highway which will materially facilitate movement of farm produce to market.

FORT ORD SERVED

In the access program on State Routes 56 and 22 in the vicinity of Fort Ord, in Monterey County, a total of 16.5 miles was graded and paved, approximately 6 miles of which is four-lane divided. This section also includes one railroad grade separation, two pedestrian crossings and two bridges.

The four-lane portion of this project, which is on the Monterey end, consists of 4.5 miles of armor coat on



Casmalia-Santa Maria Access Road. On the horizon at the right may be seen the big cut which is 100 ft. deep and contained 240,000 cu. yds. of excavation

crusher run base and 1.5 miles of Portland cement concrete pavement with curbed dividing strip. The two-lane portion, extending from Marina to U. S. 101, included 5.3 miles of Portland cement concrete pavement and 5.2 miles of plant-mixed surfacing on crusher run base. The construction period of these projects extended from March, 1942, to June, 1944.

There was a total of nine contracts covering this construction which were more fully discussed in the September-October, 1944, issue of California Highways and Public Works.

CAMP HUNTER LIGGETT

Establishment of Camp Hunter Liggett as a large mountainous training area for army personnel from various other camps necessitated construction of suitable access roads from U. S. 101 (State Highway Route 2). The route selected followed approximately along the original El Camino Real between Bradley and King City.

This project included grading and surfacing 40.4 miles and construction of two bridges. There was a total of four contracts and one WPA project involved in this section, the WPA constructing the nine-mile section through the military reservation. One bridge within the reservation was included in the WPA project while the other bridge across Pine Creek near King City, was included in the adjacent road contract. During the latter part of construction on the WPA project much of the work, including the base and surfacing, was turned over to one of the contractors on an adjacent section by the WPA. The WPA project started in May, 1941, and the last contract was completed in January, 1943.

In general, the roadway was 44 feet in width, which included a 22-foot plant-mixed surfacing 3 inches thick on cement treated base 6 inches in thickness, and 8-foot shoulders penetrated and sealed with a Class "C" medium seal coat. The plant-mixed surfacing was sealed with a Class "C" fine seal coat.

UNUSUAL FEATURE

One unusual feature of the contract on the Bradley end of the project was the utilization of the existing bridge on State Route 2 over Hames Creek as an underpass for northbound traffic turning left or westerly toward Jolon. This was done to avoid a left turn by convoys which would have tied up through traffic on the main line highway. The separation of traffic was accomplished by carrying Hames Creek through a new concrete culvert, the top of which became the base for the roadbed section on the access road.

The major portion of the 6.5 miles access road on State Route 56 between San Luis Obispo and Camp San Luis Obispo was constructed by the WPA. As the entire project was not completed on February 13, 1943, the clos-



Looking southerly toward Fort Ord on Monterey-Castroville access project on State Route 56

Looking northerly from Jolon Summit on Access Road between King City and Camp Hunter Liggett





Four lane divided P. C. C. highway between San Luis Obispo and Camp San Luis Obispo. Access highway on State Route 56

ing date of WPA activities, a project financed with access funds was approved and constructed during the year. This contract included curbs and gutters, guard rail, guide posts, surfacing of shoulders and road approaches, downdrains and other miscellaneous items of work. As in the case of the Jolon WPA project, much of the work during the latter stages of this WPA project was let to contract by the WPA because of the lack of relief labor.

CAMP SAN LUIS OBISPO

From the city limits of San Luis Obispo to past the main gate of Camp San Luis Obispo the roadbed consists of 4.5 miles of four-lane divided Portland cement concrete pavement, the remaining portions being two-lane Portland cement concrete. The WPA project included construction of a 395-foot four-span bridge across Chorro Creek, California Boulevard, a main camp road, and the camp spur of the Southern Pacific Railroad. Construction on this project ran from the beginning of WPA work in April, 1941, to the completion of the final contract in December, 1943.

In addition to the above access project between San Luis Obispo and Camp San Luis Obispo it was also necessary to relocate 7.9 miles of State Route 58 around the proposed Salinas River reservoir east of Santa Margarita which was to be constructed to provide an ample water supply for Camp San Luis Obispo. This highway relocation was designed by and constructed under the supervision of the Division of Highways although built under a negotiated contract let by the U. S. War Department. This highway relocation was constructed between August, 1941, and January, 1942.

CAMP COOKE

Access roads to Camp Cooke were constructed under three separate access projects, one project being from the northerly reservation boundary near Casmalia to Santa Maria, the other two covering the section between the easterly boundary near Lompoc and Buellton, a portion of which is on State Route 149.

The Casmalia-Santa Maria section included one contract for 13 miles of grading and surfacing and one contract for two overhead crossings of the coast line of the Southern Pacific Railroad. Except through the sections where there was heavy grading the roadbed width is 38 feet, being reduced to 28 feet through these heavy sections. The project was set up as stage construction which provided an unsurfaced plant-mixed base 6 inches thick on imported borrow 6 inches and 12 inches in depth. The plant-mixed base was produced locally, the grading of the material being predominantly on the fine side. An asphalt having a penetration of from 85 to 100 was used as a binder and the base was placed in two courses using a self-

MONTEREY COUNTY

State Highway Rte. or County Road	Location	Type of Work	Contractor	Length in Miles	Cost	Access to
Rte.	56—Seaside Jct. to N. Reservation Bdry.	Grade and Surface	M. J. Ruddy & Son	4.70	$146,649	Fort Ord
Rte.	56—N. Res. Bdry. to Marina	Grade and Pavement	Wilkinson & Scott	1.50	271,898	Fort Ord
Rte.	56—Marina to Castroville	Grade and Pavement	Granite Const. Co.	5.15	503,019	Fort Ord
Rte.	56—Tembladero Slough	Bridge	Dan Caputo	0.02	21,524	Fort Ord
Rte.	56—Fort Ord Pedestrian Crossings	Two Grade Separations	Dan Caputo		102,494	Fort Ord
Rte.	56—Salinas River at Neponset	Bridge	Oser & Sorenson	0.15	376,127	Fort Ord
Rte.	56—Salinas River at Neponset	Detour on R. R. Bridge	Day Labor		3,369	Fort Ord
Rte.	56—Salinas River at Neponset	Complete Approaches	J. B. Allen		14,271	Fort Ord
Rte.	22—Castroville to Rte. 2	Grade and Surface	Harms Bros.	5.19	465,542	Fort Ord
Rte.	22—Over S. P. R. R. near Castroville	Grade Separation	Kiss Crane Co.	0.04	45,363	Fort Ord
County	—East Garrison to Rte. 117	Grade and Surface	Granite Const. Co.	4.70	108,107	Fort Ord
County	—Hames Cr. to Hames Valley School	Grade and Surface	Louis Biasotti & Son	5.90	405,714	Camp Hunter Liggett
County	—Hames Valley School to E. Res. Bdry.	Grade and Surface	N. M. Ball Sons	13.10	654,581	Camp Hunter Liggett
County	—E. Res. Bdry. to N. Res. Bdry.	Grade, Surface and Bridge	WPA and two Subcontractors	9.04	623,037	Camp Hunter Liggett
County	—N. Res. Bdry. to Quinado Canyon	Grade and Surface	Brown, Doko & Baun	3.86	285,828	Camp Hunter Liggett
County	—Quinado Canyon to King City	Grade, Surface and Bridge	Basich Bros.	8.50	471,034	Camp Hunter Liggett
		Rights of Way on State Highways			122,489	
		Rights of Way on County Roads			39,190	
		Total Monterey County		61.85	$4,660,236	

SAN LUIS OBISPO COUNTY

State Highway Rte. or County Road	Location	Type of Work	Contractor	Length in Miles	Cost	Access to
Rte.	56—San Luis Obispo to Pennington Crk.	Grade, Pavement and Bridge	WPA and Four Subcontractors	6.45	$1,642,595	Camp San Luis Obispo
Rte.	56—San Luis Obispo to Pennington Crk.	Complete WPA Project	M. W. Stanfield Co.	(6.45)	43,184	Camp San Luis Obispo
Rte.	58—Rinconda Cr. to Salinas River	Grade and Surface	Dixon, Inc.	7.90	371,404	Road closure for Camp San Luis Obispo Reservoir
		Rights of Way on State Highways			62,847	
		Total San Luis Obispo County		14.35	$2,120,030	

SANTA BARBARA COUNTY

State Highway Rte. or County Road	Location	Type of Work	Contractor	Length in Miles	Cost	Access to
Rte.	149—Surf to Lynden School	Grade and Surface	Brown, Doko & Baun	3.50	$37,740	Camp Cooke
Rte.	2—Between Harriston and Los Alamos	Strengthen Bridge	Day Labor		1,900	Camp Cooke
Rte.	149—Buellton to Cebada Canyon	Grade and Surface	Griffith Co.	13.60	378,320	Camp Cooke
County	—Cebada Canyon to Camp Cooke	Grade and Surface	Calowell Const. Co.	3.30	188,601	Camp Cooke
County	—Casmalia to Santa Maria	Grade and Surface	Fredrickson & Watson Const. Co. & Fredrickson Bros.	12.99	756,603	Camp Cooke
County	—Over S. P. R. R. at Casmalia and Schuman	2 Grade Separations	Kiss Crane Co.	0.10	136,490	Camp Cooke
City St.	—Castillo St. to Leadbetter Rd. in City of Santa Barbara	Grade and Surface	Fredrickson & Watson Const. Co. & Fredrickson Bros.	0.60	51,799	Naval Base
		Rights of Way on State Highways			13,635	
		Rights of Way on County Roads			44,243	
		Total Santa Barbara County		34.09	$1,609,331	
		Total State Highways		48.20	$4,624,370	
		Total County Roads		62.09	3,765,227	
		Grand Total Access Projects		110.29	$8,389,597	
		12 widening, reinforcing and resurfacing contracts		93.90	1,120,244	
		Total District V		204.19	$9,509,841	

propelled spreading and finishing machine. These contracts were completed between November, 1942, and December, 1943.

BUELLTON PROJECT

The Camp Cooke-Buellton project was constructed between June, 1943, and February, 1944, under two contracts, one between the easterly reservation boundary and Route 149, the other being on Route 149 from this junction on to Buellton. The project between the camp boundary and Route 149 is on new location and eliminates a circuitous route through Lompoc with a saving of about four miles. This section is 3.3 miles in length and consists of a 22-foot by 3-inch plant-mixed surfacing on a gravel base varying in depth from 9 inches to 12 inches. The original contract provided for an asphaltic emulsion seal coat with a cover of fine screenings but due to the lateness of the season MC-5 liquid asphalt was used instead of the emulsion with very satisfactory results.

The project on Route 149 between the easterly end of the above described cutoff road and Buellton consisted of widening and resurfacing the existing pavement on portions and grading and constructing new base and surfacing on line changes. The contract was 13.6 miles in length, 2.2 miles of which was new location, the balance being the widened and resurfaced section. Construction on the widened section consisted of placing gravel base borders 4 feet wide by 6 inches to 12 inches thick on each side

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Bay Bridge Truck Lane Improvement Speeds Movement of Vital War Traffic

By H. C. SNEAD, Associate Engineer,
San Francisco-Oakland Bay Bridge

WARTIME transbay traffic over the San Francisco-Oakland Bay Bridge has assumed a pattern differing considerably from that prevailing in the prewar period. While government-imposed restrictions on gasoline and tire sales have resulted in a noticeable reduction in passenger car travel over the upper deck, increased demands on freight haulers and bus operators, together with the augmented movement of military vehicles, has resulted in a 146 per cent increase in lower-deck traffic. Bridge facilities, although taxed to the utmost at times, have stood the test of this abnormal increase in traffic reasonably well, with the exception of the east-bound lower-deck approach to the toll plaza. Here, rather severe congestion resulted during the several traffic peaks which occur in an average day's operations.

Although there are eight toll lanes in both east and west directions at the toll plaza, only two of these are equipped with scales. Lower-deck traffic must therefore be segregated into two groups if it is to be moved with a minimum of delay through the toll lanes. The commercial trucks which must be weighed for tariff purposes are dispatched into the two outside scale lanes, while the buses and military traffic, the latter toll free, are permitted to pass through any of the passenger car lanes.

As the full impact of war traffic began to be felt, segregation of the different classifications of eastbound lower-deck traffic became more and more difficult. The then existing two-lane roadway approach from the lower deck to the toll plaza was separated from the passenger car roadway by a curbed dividing strip for safety purposes. During certain times of the day, traffic peaks taxed the two-scale lanes available beyond capacity and long queues of waiting trucks formed back from the weighing devices well beyond the end of the dividing strip, as shown in Figure 1. Eastbound buses and military traffic were thus prevented from entering the toll plaza and passing through the passenger car lanes. As a consequence, delays in the movement of high priority traffic were experienced.

A study of this problem by bridge engineers indicated that a realignment of the south side of the toll plaza, to relieve the bottleneck formed by the toll plaza south curb and the dividing strip separating the lower- and upper-deck roadways, was first necessary. Coupled with this, the construction of a third lower-deck approach lane extending back approximately 1,000 feet from the toll lanes would provide adequate storage space for the maximum number of trucks waiting for the scales at any one time and, also, leave an open lane for the movement of the other classifications of lower-deck traffic. Appropriate roadway striping and signing would then reserve the third or left-hand lane in the improved area for the use of buses and military traffic.

Based on this preliminary study and design, District IV of the Division of Highways prepared plans and undertook construction of this improvement. This work, which included a new concrete pavement lane and subbase, armored shoulder, plaza sidewalks and curbs, and the relocation of lighting standards, water piping, fence and shrubbery, was completed under contract at a cost of $16,218.

Since the success of the improvement depended largely on the cooperation of the bridge patrons, the management went to considerable length to

Before Improvement—Two lane lower deck roadway on Bay Bridge blocked by waiting trucks





After Improvement—Army convoy negotiates open third lane unhampered by waiting trucks

nform them of the purpose of the im-rovement in advance of its opening. 'ublicity in the form of letters and ketches of the improved roadway were ailed to all the principal transit and rucking companies using the bridge cilities, as well as Army and Navy ommands. Through their cooperation nd that of their drivers, who prompt-l by patriotic and other meritorious otives have been our best policemen this instance, the new roadway has een a marked success.

During the first week of operation a ew drivers blocked the third or through" lane. Since then, however, uses, military traffic and emergency quipment now move through this lane ithout any delay from waiting trucks.

In Memoriam

Chester Ross Davis

The Division of Highways is mourning the death of Chester Ross Davis who passed away on June 13, 1945, after an illness of about four months. He was 55 years old.

Born in Valley, Nebraska, November 26, 1889, and educated in the schools of that State, Mr. Davis enlisted in the Navy on his eighteenth birthday anniversary. After four years' service he was engaged in civilian industry until the United States entered World War I when he again entered the Navy. He was discharged at the end of the war with the rating of warrant officer.

Mr. Davis entered the service of the State on August 22, 1928, in the Bridge Department of the Division of Highways. In October, 1931, he was transferred to the design office of the San Francisco-Oakland Bay Bridge which had just been opened in San Francisco. He worked continuously on the design, construction, and operation of the Bay Bridge from this time until September, 1940, when he was appointed engineer in charge of Carquinez and Antioch Bridges which were purchased by the State at that time. Mr. Davis served in this capacity until his death.

HIGHWAYS OF CALIFORNIA

(Continued from page 8)

Bixby Creek Bridge, 18 miles south of Carmel, is the west's longest reinforced concrete arch—342 feet. In stately grandeur, it crosses one of the most precipitous gorges, a breath-taking 270 feet above the tide. Big Creek Arch is another unusual structure. It consists of two 177-foot 6-inch arches and two hinged half-arches, all of reinforced concrete. This bridge is unique for two floating end-spans which allow for settlement of unstable ground at the abutments.

Despite the hazards and difficulties of construction, the Division of Highways has provided an interesting and scenic road benched into the bluffs of the Monterey Coast with the blue Pacific breaking in white foamed surf below and stretching off to the western horizon.

SNOW REMOVAL IN THE SIERRA

One of the most important and heavily traveled transcontinental American highways is U. S. 40. In California, this route crosses the Sierra over the historic Donner Summit at elevation 7,135.

This pass is situated between Reno and Sacramento about nine miles west of Truckee and is the location of the heaviest snowfall in the United States. Because of the importance of the route to highway transportation, it has been the policy of the Division of Highways to keep this road and highways of similar importance open to traffic throughout the entire winter.

Records of annual snowfall at the Norden Station of the U. S. Weather Bureau near the summit show average falls varying from about 300 to 500 inches, with falls during some years considerably higher, as for instance, during the winter of 1879-80 the snowfall totaled 783 inches and during recent years, the winter of 1937-1938, a near record of 598 inches of snow fell. It was estimated that during that winter maintenance crews removed a total of over 100,000,000 cubic yards of snow from various routes in the State Highway System.

SNOW REMOVAL PROCEDURE

The procedure followed by snow removal crews follows a general pattern. As soon as a storm starts, the plows and blowers move out onto the highway. The practice is to keep the equipment working throughout the storm and as long thereafter as is necessary to completely clear the highway. In addition to clearing the roads of the snowfall and drifts, at certain locations there is also the problem of combating snow slides which may be of very considerable proportions. In one instance during the 1937-1938 winter a large slide at Deer Park on the highway between Truckee and Tahoe City required continuous operations for 12 hours in order to open a section 300 feet in length.

COST OF SNOW REMOVAL

The volume and cost of snow removal on the State Highway System varies with the severity of the season and the grouping of storm periods. During the eight seasons from 1936 to 1944 annual snow removal costs have amounted to the following:

1936-37	$605,000	1940-41	$420,000
1937-38	492,000	1941-42	524,000
1938-39	382,000	1942-43	331,000
1939-40	323,000	1943-44	516,000

The number of miles cleared each season does not of necessity follow the pattern of costs as is evidenced by the following figures for the six years from 1938 to 1944:

1938-39	4,189 miles	1941-42	4,130 miles
1939-40	3,281 miles	1942-43	4,343 miles
1940-41	3,809 miles	1943-44	4,200 miles

To conduct snow removal operations throughout the State Highway System, the Division of Highways has 30 auger type plows, 155 blade and V-type plows, two wideners, and one roto-blade. For safer and more efficient operation the larger units are equipped with both receiving and sending radio equipment for communication with the headquarters at the maintenance stations.

During the winter and early spring months the life of maintenance crews assigned to snow removal is lived far from a bed of roses. No matter what time of day or night a storm may start, operations begin immediately and work is carried through without cessation. This means long hours of strain and work so that State roads may be opened to traffic as soon as possible.

NOTE.—This is the first of a series of articles on Highways of California by Mr. Gallagher.

Bridge Maintenance

(Continued from page 20)

been included in repair work where practical.

Normal maintenance procedure during times of high water usually includes only the removal of drift and trash which may hang up on bridge piers and cause scour. Bed scour can not usually be detected while the stream is in flood until there has been settlement of the bridge but even then much can be done to prevent further damage. For example, a quantity of riprap dumped into the channel at the upstream end of an undermined pier may prevent additional damage, and will at least reduce the amount of differential settlement.

Bank scour which may damage the bridge foundations can be detected at once and controlled to some extent if the proper measures are taken. Scouring eddys can be broken up with a few well placed boulders or sand bags. Railroads appear to have had considerable success in emergency scour control by using large irregular shaped stones. Highway maintenance forces are usually not equipped to handle stones of such size under emergency conditions. They could be so equipped at small cost and it is believed that considerable expense for such preventative maintenance is justified.

Federal Aid to Secondary Roads Given Attention

(Continued from page 9)

for the purpose of matching the Federal funds, there are no funds available for expenditure at this time from these two sources. The purpose of the Federal Act is to provide for postwar construction.

Many of the counties have taken advantage of funds provided for under Senate Bill No. 1083, Chapter 565 for the purpose of preparing plans and specifications for postwar construction upon county highways. Of the plans now in preparation under this act, about $10,000,000 of proposed construction will fall upon the proposed Federal Aid Secondary System. In fact some of the counties have sufficient program on the system to absorb all of the three-year funds. The funds which will be available for county road construction under the Federal and State Acts will be $25,550,916.

CALIFORNIA MISSIONS

(Continued from page 16)

money. A new fund was raised, but the earthquake of April 18, 1906, that wrought such destruction in San Francisco, Santa Rosa, Palo Alto and other cities, hit Mission San Antonio also, and did much damage. Discouraged, but still determined to save something of the ancient mission, the Native Sons again set about restoration work, applying themselves intermittently to the task and whenever funds were available up to 1911.

Today there is not much left of San Antonio. Its ruins, a tower in which still hangs the mission bell, are a tragic reminder of the historic past, of the romantic period of the Franciscan padres in California.

While Mission San Antonio is situated some 18 miles off El Camino Real, the Coast Highway, U. S. 101, southwest of King City, and about 24 miles off the same highway northwest of Bradley, it is easily reached by automobile from either of these points.

The mission visitor from the south, after leaving San Miguel and Mission San Miguel Arcangel, will follow the Coast Highway to Bradley and there turn left and proceed in a northwesterly direction to the town of Jolon and Mission San Antonio.

Coming from the north, the route is direct from San Francisco on the Coast Highway to King City, thence southwest to Jolon.

The Inland Route through the San Joaquin Valley offers two highways to the mission. Motorists coming from the north will turn west at Hanford and proceed over the Sierra to the Sea Highway through Lemoore and Coalinga to San Lucas, thence north 9 miles to King City and from there take the road to Jolon. Motoring north over the Inland Route, the visitor may take the Cholame lateral out of Bakersfield, proceed to Paso Robles and then go north through San Miguel to Bradley and thence northwest to Jolon.



The old bell of Mission San Antonio still hangs in its tower

Next—Mission San Miguel Arcangel and Mission Nuestra Senora de la Soledad.

War Time Highway Construction in District V Aggregated $9,500,000

(Continued from page 25)

of the existing 15 feet by 4 inches asphaltic concrete pavement to provide a 23-foot wide base for the resurfacing. This base was covered with plant-mixed surfacing and a seal coat with screenings. On portions of the project where the existing pavement showed signs of distress it was covered with a gravel blanket 6 inches to 12 inches thick to provide additional stability. On the line changes a gravel base 23 feet wide by 9 inches to 12 inches thick was surfaced with 3 inches of plant-mixed surfacing and a seal coat.

A complete description of some of the smaller access projects has not been included, however, the accompanying table provides a general outline of the work accomplished.

This large program was under the general supervision of District Construction Engineer B. W. Booker until September, 1942, and District Construction Engineer C. E. Waite from this date until its completion.

The table accompanying this article gives a list of the projects, type of project, contractor and costs.

Less Accidents on Arroyo Seco Parkway Than on Some Los Angeles City Streets

(Continued from page 3)



A not unusual traffic jam at Figueroa and Vernon streets in Los Angeles

the semaphore type. These vary in spacing from a minimum of 520 feet to a maximum of 1827 feet.

WILSHIRE BOULEVARD

From East City Limits of Beverly Hills to Vermont Avenue, 4.65 miles.

Wilshire Boulevard extends approximately east and west with a small angle about one mile east of Beverly Hills.

The pavement is asphaltic and from Beverly Hills to Ogden Drive, a distance of about three-fourths mile, is 80 feet wide between curbs, the balance being 70 feet wide between curbs.

There is a double painted centerline stripe throughout, and two single painted stripes on either side of the center stripe, each 10 feet apart.

Parallel parking in an eight-foot width is permitted throughout.

This marking provides six traffic lanes throughout. In the portion which is 80 feet wide between curbs there is a width of 12 feet between the outer stripe and the parking lane, while in the portion with the 70-foot width between curbs there is only seven feet between the outer stripe and the parking lane.

The lighting on Wilshire is the best of all the streets used in this study and consists of cast iron standards erected along the curbs with two light units each. Thirty-one intersections are controlled by three-light automatic signals on this section of Wilshire Boulevard. These vary in spacing from a minimum of 317 feet, to a maximum of 1954 feet.

Accident data for this study were secured from accident reports in the files of the Traffic Bureau of the Department of Police of Los Angeles through the kindness of B. R. Caldwell, Deputy Chief, Director of the Traffic Bureau, and his able and helpful staff.

Accident data for that portion of the Arroyo Seco Parkway in the City of South Pasadena were secured from accident reports kindly made available by the Traffic Department of the City of South Pasadena.

Deserved Promotion

Friends of Major Wm. H. King, who before the war was employed on the San Francisco-Oakland Bay Bridge, have learned with pleasure that he has been promoted to Lieutenant Colonel in the 40th Infantry Division now in the Philippines.

Colonel King, husband of Mrs. Ida G. King, 141 Elm Avenue, San Bruno, California, as ordinance officer of the 40th Division, is responsible for the requisition, repair and maintenance of all weapons and all motor vehicles in the division.

Highway Bids and Contract Awards for June and July 1945

June 1945

ALAMEDA COUNTY—An access road rom Maitland Drive to Earhart Road in the uxiliary Naval Air Station, Oakland Air ort, about 1.2 miles in length to be graded nd surfaced with plant mixed surfacing on rusher run base and imported base material. District IV. Lee J. Immel, Berkeley, $151,77; N. M. Ball Sons, Berkeley, $161,249. ontract awarded to Frederickson & Watson onstruction Co., Oakland, $147,179.

KERN COUNTY—Between Mojave and ines, portions only, a net length of about 6 iles to be repaired by reshaping shoulders, pplying prime coat and placing P. M. S. over xisting surfacing and portions of shoulders, lacing imported borrow on shoulders and pplying penetration treatment thereto. Dis ict IX, Route 23, Section B. W. I. "Bill" erry, Bakersfield, $45,290. Contract award- l to Oilfields Trucking Co., Bakersfield, $42,-80.

KERN COUNTY—Between 1.2 miles south Famoso and 1.0 miles north of Famoso, bout 2.2 miles, to be repaired with plant- ixed surfacing. District VI, Route 4, Sec- on E. Contract awarded to Griffith Com- any, Los Angeles, $30,481.

KERN COUNTY—Between 14.8 and 17.8 iles east of Maricopa, between State High- ay Route 139 and Rosedale and between 2.8 nd 3.8 miles north of State Highway Route 0, about 10.1 miles net length, to be re- ired with plant-mixed surfacing. District 1, Routes 57, 58, 139, Sections C, L, A. ontract awarded to Griffith Co., Los Angeles, 3,960.

MENDOCINO COUNTY—Between Long le and Laytonville, portions only, about 2.9 iles in net length, imported base material to furnished and placed and armor coat to be pplied thereto. District I, Route 1, Sections H. W. C. Thompson, San Francisco, $12,-61; Close Building Supply, Hayward, $13,-0; Clements & Co., Hayward, $16,393; W. Railing, Redwood City, $17,460; N. M. all Sons, Berkeley, $18,512; C. M. Syar, allejo, $53,964. Contract awarded to A. R. cEwen, Sacramento, $12,337.

MENDOCINO COUNTY—Between North- estern Pacific Railroad Underpass and 1.1 iles south of Willits, about 2 miles in length, mported base material to be furnished and aced and armor coat to be applied thereto. istrict I, Route 1, Section E. Clements & o., Hayward, $24,144; Close Building Sup- y, Hayward, $28,375; W. C. Thompson, San rancisco, $28,880; W. C. Railing, Redwood ity, $29,928; C. M. Syar, Vallejo, $36,155; ester Sorensen, Redwood City, $37,504; N. M. all Sons, Berkeley, $50,565. Contract warded to A. R. McEwen, Sacramento, $23,-3.

MENDOCINO COUNTY—Between Na- rro River and Mendocino, portions only, a t distance of about 1.9 miles, imported base aterial to be furnished and placed and seal at applied thereto. District I, Route 56, ection D. J. Henry Harris, Berkeley, $30,-9; C. M. Syar, Vallejo, $30,702; A. J. Clau- n, Berkeley, $41,730. Contract awarded to . C. Railing, Redwood City, $26,341.

MERCED COUNTY—Between 1.7 miles st of San Luis Creek and Los Banos and between 1.7 miles north of Romero School and Los Banos, portions only, about 13 miles in net length, to be repaired with untreated rock base and plant mixed surfacing. District X, Routes 32 and 11, Sections B, AB. N. M. Ball Sons, Berkeley, $190,392; W. C. Thompson, San Francisco, $216,819; Lee J. Immel, Berkeley, $217,476; J. E. Haddock, Ltd., Pasadena, $232,724; E. B. Bishop, Orland, $239,-152. Contract awarded to Louis Biasotti & Son, Stockton, $180,747.

MONTEREY, SAN LUIS OBISPO AND SANTA BARBARA COUNTIES—Painting maintenance station buildings at Big Sur, Willow Springs, San Lucas, Priest Valley, Cambria, Shandon, Santa Maria, Buckhorn, Cuyama, Buellton, and Santa Barbara. District V. Wm. R. Morgan & Co., Los Angeles, $9,495. Contract awarded to Dan Sullivan, Santa Monica, $7,890.

NAPA COUNTY—Veterans Home at Yountville, about 1.8 miles in length, existing bituminous surfaced roads within institution grounds to be scarified, recompacted and an armor coat applied, and unsurfaced existing roads to be surfaced with crusher run base and penetration treatment applied thereto. District IV. C. M. Syar, Vallejo, $7,565; A. S. Jones, Napa, $8,735; A. J. Clausen, Berkeley, $9,180; K. R. C. Construction Co., Berkeley, $9,411; J. Henry Harris, Berkeley, $9,656; E. A. Forde, San Anselmo, $10,117; J. C. Spaletta, Santa Rosa, $12,670; Peter Sorensen, Redwood City, $13,956. Contract awarded to Lee J. Immel, Berkeley, $7,271.

NEVADA COUNTY—Portions between Truckee and Farad, about 3.4 miles in net length, to be repaired with plant-mixed surfacing, and crusher run base and plant-mixed surfacing to be stockpiled. District III, Route 38, Sections A, B. Isbell Construction Company, Reno, $46,745. Contract awarded to Harms Bros., Sacramento, $46,035.

RIVERSIDE AND SAN BERNARDINO COUNTIES—Between Riverside and Colton about 2.6 miles in net length, to be repaired by placing plant-mixed surfacing with seal coat over the existing surface, placing local borrow on portions of the shoulders and reshaping shoulders. District VIII, Route 43, Sections C, F. E. L. Yeager, Riverside, $28,-270; Griffith Co., Los Angeles, $35,540. Contract awarded to Geo. Herz & Co., San Bernardino, $27,950.

SACRAMENTO COUNTY—Between Isleton and Sacramento, portions only, about 8.5 miles in net length to be repaired with plant-mixed surfacing. District III, Route 11, Sections D, E, F. A. Teichert & Co., Sacramento, $43,945; Asta Construction Co., Rio Vista, $46,310; McGillivray Construction Co., Sacramento, $49,104; Louis Biasotti & Son, Stockton, $52,228. Contract awarded to Sheldon Oil Co., Suisun, $41,733.

SACRAMENTO AND YOLO COUNTIES—Between North Sacramento and about 2 miles easterly and between one mile east of Davis and Swingle, about 4.8 miles in net length, to be repaired with plant-mixed surfacing on existing roadbed and on new crusher run base. District III, Routes 3 and 6, Sections B, A. McGillivray Construction Co., Sacramento, $82,208; Louis Biasotti & Son, Stockton, $87,365; J. R. Reeves, Sacramento, $93,792. Contract awarded to A. Teichert & Co., Sacramento, $81,935.

SAN BERNARDINO COUNTY—Between Barstow and Field, about 22 miles in net length, to be repaired by placing plant mixed surfacing over the existing surface and reshaping the shoulders. District VIII, Route 31, Sections G, H. The Tanner Construction Co., Phoenix, Arizona, $179,330; Basich Bros. Construction Co., Alhambra, $197,280; Lewis Construction Co., Los Angeles, $197,-472; Oswald Bros., Los Angeles, $200,006; Matich Bros., Colton, $205,260; Griffith Co., Los Angeles, $220,175; J. E. Haddock, Ltd., Pasadena, $221,195; Dinmitt & Taylor, Los Angeles, $239,510. Contract awarded to Schroeder & Co., Roscoe, $173,775.

SAN BERNARDINO COUNTY—Between Daggett and Hector, about 7.25 miles in net length, to be repaired by placing plant-mixed surfacing over the existing surface and reshaping the shoulders. District VIII, Route 58, Sections F, G. Matich Bros., Colton, $50,000; Lewis Construction Co., Los Angeles, $51,532; Oswald Bros., Los Angeles, $63,255; Basich Bros. Construction Co., Alhambra, $63,387; Geo. Herz & Co., San Bernardino, $63,756; Griffith Co., Los Angeles, $70,615; Dinmitt & Taylor, Los Angeles, $81,352. Contract awarded to The Tanner Construction Co., Phoenix, $49,175.

SAN JOAQUIN COUNTY—Between Stanislaus River and Manteca, about 7.1 miles to be repaired with plant-mixed surfacing. District X, Route 4, Section A. M. J. B. Construction Co., Stockton, $50,220; Clements & Co., Hayward, $50,372. Contract awarded to A. Teichert & Co., Sacramento, $43,397.

SISKIYOU COUNTY—Between 4 miles north of Weed and Oregon State line, about 14.8 miles in net length, a Class "A-Medium" seal coat to be applied. District II, Route 72, Section A, Drs, C. Clifford A. Dunn, Klamath Falls, Oregon, $19,829; Harms Bros., Sacramento, $20,167. Contract awarded to W. C. Thompson, San Francisco, $19,187.

SONOMA COUNTY—Between Bettane and Agua Caliente, portions only, about 3 miles in net length to be repaired by scarifying and reshaping existing surfacing and base, constructing crusher run base and placing plant mixed surfacing. District IV, Route 51, Section B. N. M. Ball Sons, Berkeley, $84,-305; Lee J. Immel, Berkeley, $85,629; C. M. Syar, Vallejo, $86,358; A. G. Raisch Co., San Francisco, $86,450; E. A. Forde, San Anselmo, $87,702. Contract awarded to Louis Biasotti & Son, Stockton, $81,585.

YUBA AND SUTTER COUNTIES—Between Morrison Crossing and Linda Corners, between Yuba City and Lomo, portions, and between Sutter Bypass and Tudor Road, about 12.2 miles in net length, to be repaired with plant mixed surfacing on existing roadbed and borders to be constructed of imported borrow on portions of the project. District III Routes 3, 87, Sections B, A, B. Marshall S. Hanrahan, Redwood City, $124,877; Louis Biasotti & Son, Stockton, $126,382; E. B. Bishop, Orland, $147,180. Contract awarded to Lester L. Rice, Marysville, $94,-690.

VENTURA COUNTY—Between 0.6 mile northwesterly of Hueneme Road and Calleguas Creek, about 3.4 miles in length, to be

repaired with plant-mixed surfacing on untreated rock base. District VII, Route 60, Section A. R. R. Hensler, Glendale, $119,930; Frontier Construction Company, Whittier, $120,976; Norman I. Fadel, North Hollywood, $121,180; Oswald Bros., Los Angeles, $124,820. Contract awarded to Griffith Co., Los Angeles, $114,735.

YOLO COUNTY—Between Madison and 2.5 miles south of Dunnigan, about 9.4 miles to be repaired with gravel base and penetration treatment. District III, Route 90, Section B. K. R. C. Construction Company, Berkeley, $24,640; N. M. Ball Sons, Berkeley, $26,308; A. J. Clausen, Berkeley, $28,287; Harms Bros., Sacramento, $29,000; F. E. Young, Berkeley, $29,266; A. Teichert & Co., Sacramento, $29,525; Clements & Co., Hayward, $32,031; C. M. Syar, Vallejo, $32,512; E. B. Bishop, Orland, $36,375; Nevada Rock & Sand Co. Inc., Reno, $39,497; Louis Biasotti & Son, Stockton, $48,840. Contract awarded to R. A. Westbrook, Sacramento, $23,890.

YOLO COUNTY—Between Davis Wye and Willow Slough, between Cache Creek and 3 miles north and between Woodland and 1.3 miles north, about 8.1 miles in net length, to be repaired with plant-mixed surfacing on existing roadbed and with plant-mixed surfacing on crusher run base and the shoulders to be constructed of imported borrow on portions of the project. District III, Routes 7, 87, Sections A, V, Wd. A. W. C. Thompson, San Francisco, $118,770; A. Teichert & Co., Sacramento, $125,649; Clements & Co., Hayward, $131,617; Harms Bros., Sacramento, $139,840; Louis Biasotti & Son, Stockton, $152,784; E. B. Bishop, Orland, $156,928. Contract awarded to N. M. Ball Sons, Berkeley, $117,925.

July 1945

ALAMEDA COUNTY—Between San Joaquin County line and Livermore and between Niles and Sunol, about 6 miles to be repaired with plant-mixed surfacing. District IV, Routes 5, 107, Sections E, A. W. C. Railing, Redwood City, $31,101. Contract awarded to Clements & Co., Hayward, $27,797.50.

ALAMEDA COUNTY—Along Ward Creek, at Hayward, a reinforced concrete box culvert and trash box to be constructed. District IV, Route 105, Section Hayward, A. Clements & Co., Hayward, $9,630; R. G. Clifford, South San Francisco, $9,775; Dan Caputo, San Jose, $9,891; A. Soda & Son, Oakland, $12,910; Minton & Kubon, San Francisco, $13,285; Peter Sorensen, Redwood City, $15,281. Contract awarded to Wm. E. Thomas Construction Co., National City, $8,906.

CONTRA COSTA COUNTY—Between Concord and Ohmer, about 2.5 miles to be surfaced with plant-mixed surfacing on existing pavement and on new crusher run base. District IV, Clements & Co., Hayward, $29,837; Fredrickson & Watson Construction Co., Oakland, $30,513; C. M. Syar, Vallejo, $31,466; A. J. Raisch Paving Company, San Jose, $39,176. Contract awarded to Lee J. Immel, Berkeley, $29,422.

GLENN COUNTY—Between Oak Street in Willows and Orland, about 1.3 miles to be repaired with plant mixed surfacing. District III, Route 7, Section Willows, B, C. N. M. Ball Sons, Berkeley, $19,100. Contract awarded to E. B. Bishop, Orland, $13,300.

INYO COUNTY—Between Fish Creek Road and Bishop, portions about 6.2 miles in net length, to be repaired with imported borrow and plant-mixed surfacing. District IX, Route 23, Sections C, D. Vinnell Company, Alhambra, $72,540. Contract awarded to Basich Brothers Construction Co., Alhambra, $55,750.

INYO AND MONO COUNTIES—Between Alabama Gates and Whiskey Canyon, portions about 6.2 miles in net length, to be repaired by placing road-mixed surfacing over existing surfacing and reshaping existing shoulders. District IX, Route 23, Sections MB, AB. Basich Brothers Construction Co., Alhambra, $19,192; R. R. Hensler, Glendale, $20,540. Contract awarded to Vinnell Company, Alhambra, $17,918.50.

KINGS AND TULARE COUNTIES—Between Hanford and State Highway Route 4, about 12.8 miles to be repaired with plant-mixed surfacing. District VI, Route 10, Sections A, A. Contract awarded to Brown, Doko and Baun, Pismo Beach, $28,509.

LOS ANGELES COUNTY—In the city of El Segundo on El Segundo Boulevard, between Main Street and Sepulveda Boulevard, about 1.1 miles to be graded and surfaced with plant-mixed surfacing. District VII. Dimmitt & Taylor, Los Angeles, $39,954; Oswald Bros., Los Angeles, $40,448; Griffith Co., Los Angeles, $41,749; Charles J. Dorfman, Los Angeles, $42,031; J. E. Haddock, Ltd., Pasadena, $43,076; Warren Southwest, Inc., Los Angeles, $43,706; Chas. T. Brown Co., San Fernando, $44,031. Contract awarded to Vido Kovacevich Co., South Gate, $39,680.

MARIN COUNTY—Between San Rafael and San Quentin Wye, about 0.5 mile, an outer highway to be graded and surfaced with crusher run base and seal coat to be applied. District IV, Route 1, Section San Rafael, C. W. C. Railing, Redwood City, $11,071; A. G. Raisch Co., San Francisco, $11,275; J. Henry Harris, Berkeley, $11,703; Peter Sorensen, Redwood City, $12,392; C. M. Syar, Vallejo, $12,585. Contract awarded to E. A. Forde, San Anselmo, $10,116.

MENDOCINO COUNTY—About 8 miles north of Cloverdale, the existing bridge across Squaw Rock Slide to be repaired. District I, Route 1, Section L. Reed & Tuttle, Redwood Valley, $9,940; James H. McFarland, San Francisco, $10,217; Kiss Crane Co., San Pablo, $11,585; John C. Spaletta, Santa Rosa, $13,065; Mercer-Fraser Co., Eureka, $14,650. Contract awarded to C. C. Gildersleeve, Willows, $8,740.

MENDOCINO COUNTY—At Chadburn Creek, about 13.4 miles north of Fort Bragg, about 0.17 mile to be graded, surfaced with imported base material and a seal coat applied thereto. District I, Route 56, Section F. C. M. Syar, Vallejo, $27,557; J. Henry Harris, Berkeley, $29,624; W. C. Railing, Redwood City, $31,964. Contract awarded to John Burman & Sons, Eureka, $19,083.

MONTEREY COUNTY—Between San Ardo and King City, portions, about 8.7 miles in length, to be repaired by placing plant-mixed surfacing over the existing surfacing, reshaping existing shoulders and applying bituminous surface treatment thereto, applying seal coat to the plant-mixed surfacing and a liquid asphalt seal with sand cover to the shoulders. District V, Route 2, Sections G, F. Granite Construction Co., Watsonville, $106,954; Brown, Doko Baun, Pismo Beach, $113,278. Contract awarded to A. Teichert & Co., Sacramento, $99,869.

NAPA AND SONOMA COUNTIES—Between Napa and Oakville and between Santa Rosa and Beltane, about 7.5 miles to be repaired with plant-mixed surfacing. District IV, Routes 49, 51, Sections B, A. J. Henry Harris, Berkeley, $44,424; E. A. Forde, San Anselmo, $43,560. Contract awarded to A. A. Tieslau & Son, Berkeley, $42,658.

PLACER-NEVADA COUNTIES—Between Gold Run and Kingvale, portions only, about 7.8 miles to be repaired with plant-mixed surfacing on existing roadbed and on new crusher run base. District III, Route 37, Sections DEF, A. R. A. Westbrook, Sacramento, $49,302; Harms Bros., Sacramento, $62,430. Contract awarded to Clements & Co., Hayward, $48,926.25.

SANTA CLARA COUNTY—Between Gilroy and 4 miles southerly, portions only, about 2.4 miles to be repaired by surfacing with plant-mixed surfacing. District IV, Route 2, Section C. A. J. Raisch Paving Company, San Jose, $28,767; H. Sykes, Patterson, $33,146. Contract awarded to Granite Construction Co., Watsonville, $26,088.50.

SANTA CLARA COUNTY—Between Alameda County Line and Milpitas, between Los Gatos and San Jose, between Saratoga and Los Gatos, and between Sunnyvale and Saratoga, a net total length of about 11 miles, to be repaired with plant-mixed surfacing. District IV, Routes 5, 42, 114, Sections AB, A, A. Contract awarded to A. J. Raisch Paving Co., San Jose, $57,531.

SAN LUIS OBISPO COUNTY—Between Del Rio Avenue and Templeton, between Paso Robles and Monterey County Line, and between Estrella River and Cottonwood Pass Road, portions only, about 17.4 miles in net length, to be repaired by placing plant-mixed surfacing with an emulsion seal on Route 33 and applying a seal coat to existing surfacing on Route 2, District V, Routes 2, 33, Sections BA, BC. Contract awarded to Granite Construction Co., Watsonville, $39,970.

SHASTA COUNTY—Between Bass Hill & Crespo's, portions only about 14 miles in net length, to be repaired by applying seal coat to the existing surfacing. District II, Route 3, Sections B, C. E. B. Bishop, Orland, $17,300; A. A. Tieslau & Son, Berkeley, $17,680. Contract awarded to J. Henry Harris, Berkeley, $15,789.15.

TEHAMA COUNTY—Between Route 3 and 3 miles east of Paynes Creek, about 23.6 miles to be repaired with seal coat. District II, Route 29, Sections A, B. Clements & Co., Hayward, $21,175; Marshall S. Hanrahan, Redwood City, $21,810; Howard B. Folsom, Berkeley, $23,442; W. C. Railing, Redwood City, $24,405; A. A. Tieslau & Son, Berkeley, $24,407; E. B. Bishop, Orland, $24,775. Contract awarded to J. Henry Harris, Berkeley, $20,590.50.

YOLO COUNTY—Between 0.5 mile south of Arcade Station and 2.25 miles north of Arcade Station and between the Yolo Causeway and 1 mile west of Washington Underpass, about 5.3 miles in length to be repaired with plant-mixed surfacing. District III, Routes 99, 6, Sections B, C. McGillivray Construction Co., Sacramento, $34,420. Contract awarded to A. Teichert & Co., Sacramento, $32,915.

YOLO AND COLUSA COUNTIES—Between Bretona and Genevra (portions) about 1.7 miles to be repaired with plant-mixed surfacing. District III, Route 7, Sections C, A. E. B. Bishop, Orland, $11,500. Contract awarded to N. M. Ball Sons, Berkeley, $11,130.

State of California

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DIVISION OF CONTRACTS AND RIGHTS OF WAY (LEGAL)

C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney

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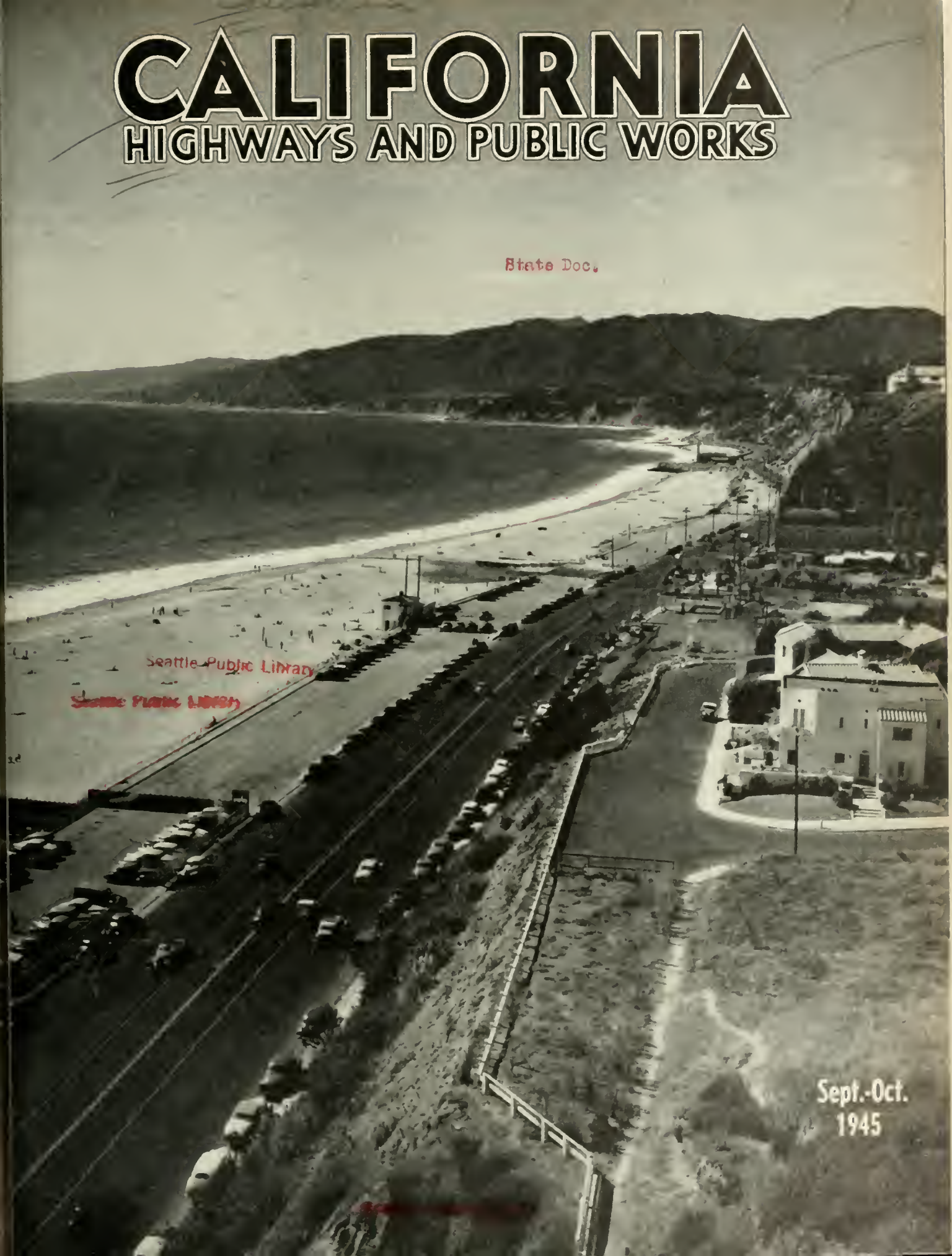
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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director GEORGE T. McCOY, State Highway Engineer K. C. ADAMS, Editor

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Governor Earl Warren on tour of northern section of Redwood Empire with the California Highway Commission. Left to right: Homer P. Brown, Placerville; C. Arnholt Smith, San Diego; James A. Guthrie, San Bernardino; C. H. Purcell, Director of Public Works and chairman of Commission; Governor Warren; Chester H. Warlow, Fresno; Harrison R. Baker, Pasadena, and Walter Sandelin, Ukiah

Governor Wants Redwoods Saved

ON A TOUR of the northern section of the Redwood Empire Governor Earl Warren on September 25th and 26th viewed at first hand the highway needs and the State parks and beaches in Mendocino, Humboldt and Del Norte counties.

The Governor was accompanied on his trip by all the members of the California Highway Commission, State Highway Engineer George T. McCoy, members and officers of the State Park Commission and officials of the Redwood Empire Association and of the three counties visited.

In addresses at Ukiah, Eureka and Crescent City, Governor Warren placed emphasis on the duty of the State to coordinate future highway development in the Redwood Empire with the necessity for preserving the magnificent redwood trees for posterity and the improvement of State parks and beach facilities in the area. He shared this ambition with Chairman Joseph R. Knowland of the State Park Commission and Director of Public Works C. H. Purcell, who is also chairman of the California Highway Commission.

More than 400 persons attended a banquet which was given in the municipal auditorium in Eureka on Wednesday night, September 26th in honor of the Governor. In talks at luncheons at Ukiah and Crescent City, the Governor spoke briefly and emphatically on the theme of protecting the redwoods and developing parks and beaches but made his principal address in Eureka. Introduced at the banquet by Past President Paul Mudget of the Redwood Empire Association, the Governor discussed the postwar problems which confront California.

"We can not make prosperity through Government jobs," he said, "the big job in our State is to provide employment for more than 2,000,000 persons who have come here during the war and who will for the most part remain here. Private enterprise must take care of these. We must solve our problems through cooperation and tolerance. We must develop our resources to provide such employment.

"Our State Government has been making preparations for the reconversion. More than $300,000,000 of State funds have been saved up for postwar work and this money will be expended to build permanent improvements on our highways, at our State institutions, in our State parks and on our splendid beaches. These must be jobs of all kinds provided. It looks like a big task but I am not in any way pessimistic. California has met other large problems and we will meet this one."

In addresses to audiences at Ukiah, Crescent City and Eureka, Chairman Purcell said that the State is ready to



Joseph R. Knowland, Oakland, chairman of the California State Park Commission, points to one of majestic redwood trees which line U. S. 101 in the heart of the redwood belt. On his right are State Highway Engineer George T. McCoy, C. H. Purcell, chairman of the Highway Commission, and Governor Warren

take up where it left off almost four years ago the development of the State Highway System. He announced that the Highway Commission has launched its $115,000,000 postwar highway building program by allocating approximately $49,000,000 to designated projects which will be advertised for bids prior to June 30, 1946. He said some projects in the postwar program will be advertised for construction this fall and that once started the advertising for bids and the letting of contracts will proceed in an orderly manner and be carried on continuously consistent with the ability of the road construction industry to keep abreast of the program.

Mr. Purcell said that highway and bridge projects within the Redwood Empire and which are included in the initial program of the Division of Highways will total $14,193,300.

While highways, parks and beaches were given major consideration by Governor Warren, Mr. Purcell and Mr. Knowland, the Governor took occasion at the Ukiah luncheon to mention the Mendocino State Hospital and to praise Senator George M. Biggar, of Covelo, and Assemblyman Michael J. Burns, of Eureka, for their interest in State highways, State parks and governmental problems generally.

"I have never thought that Mendocino had the proper maximum security institution for mental cases," the Governor declared. "I believe we should handle menace cases in a special hospital and this is a problem to which we will give serious consideration."

The Highway Commission and the State Park Commission met the Governor at Ukiah where a luncheon was tendered by the Ukiah Chamber of Commerce at the Palace Hotel, with Superior Judge Lilburn Gibson presiding, after which the Mendocino board of supervisors conducted the official caravan to Hartsook where the Humboldt board of supervisors took over as guide. Pausing at various redwood groves, the Governor and his party drove to Scotia for an overnight stop.

On Wednesday the caravan proceeded from Scotia to Crescent City in Del Norte County.

The Del Norte board of supervisors greeted the party at the Humboldt-Del Norte County line and after a brief stop at Wilson Creek beach the caravan was escorted to Hotel Lauff in Crescent City where the chamber of commerce was host at luncheon. President Errol Winn of the Chamber

(Continued on page 31)

Scenes like the one on the opposite page, a section of the Redwood Highway in Humboldt County, are what Governor Warren desires the State of California to preserve for all time



HIGHWAYS OF CALIFORNIA

By J. D. GALLAGHER, Associate Highway Engineer

This is the second in a series of articles on Highways of California by Mr. Gallagher.—Ed.

MOTHER LODE HIGHWAY

From an historical point of view, one of the most interesting State routes is the Mother Lode Highway which traverses the heart of California's early gold mining country. The northerly terminous of this route is the City of Auburn, in Placer County; from this point the highway extends southerly through the Sierra foothills to Mariposa, a distance of 169 miles. The route is well surfaced throughout its entire length. The country touched by this route was the setting for much of California's gold rush, when many an early-day miner searched these hills for the fabulous Mother Lode, mythical source of the yellow wealth. A list of towns and place-names in the region through which this highway passes would furnish a good index for Bret Harte stories or the early writings of Mark Twain.

Between Auburn and Placerville the route passes through the old settlement of Coloma on the South Fork of the American River, where in 1848 the millwright, James W. Marshall, touched off the California gold rush by discovery of gold in the tail-race of a sawmill he was operating for Captain John Sutter. From here the highway then moves down into old Placerville, referred to by forty-niners as "Hangtown," because of its speedy and final system of frontier justice to malefactors against the pioneer code.

HISTORIC SPOTS

From Placerville, the Mother Lode traverses oak-covered rolling foothills dotted with towns bearing those picturesque names so reminiscent of the free and easy days of the gold rush: El Dorado, Fiddletown, Fair Play, Grizzly Flat, and Dry Town. From Dry Town, the oldest community in Amador County the name of which was a misnomer in the early-days as far as liquid refreshment was concerned, the highway, crossing through a saddle in the ridge south of Rancheria Creek, follows up Amador Creek to the sleepy village of Amador City where crumbling buildings are the chief evidence of the one-time activity around the old Keystone mine. The road crosses the next ridge at the same point as the old "Amador Trail" of the '50's, evidence of which may be seen in the old stone walls and grass covered roadway. In the valley below this summit lies the attractive town of Sutter Creek, with neat lawns and houses settled beneath large shade trees. While many of the buildings here date back to the roaring gold days, most have had facial treatments, concealing their age behind modern fronts which to some degree detract from the old time atmosphere of the vicinity.

Leaving Plymouth, the motorist may see the old so-called Hetty Green mine, formerly the Eureka, which is now owned by the Central Eureka Company. In 1859, Alving A. Hayward bought this property and between 1852 and 1881 it had produced $13,000,000. Hetty Green, who amassed a fabulous fortune, owned the mine for a period and it still is popularly referred to as the Hetty Green mine.

INTO AMADOR

Out of this valley the highway continues southerly to a junction at Martel with the Jackson lateral and continues on down to Jackson, the county seat of Amador County. Adjacent to the highway on the outskirts of Jackson are the properties and workings of the famous Argonaut and Kennedy mines, two of the largest in California. Because of these two mines, there is a large population of hard-rock miners in Jackson and the town retains a typical mining atmosphere in spite of the modernization of many of the buildings. The old court house is a point of considerable historic interest, where even as late as 12 or 15 years ago, the old town well with its bucket and rope was in general use by the neighborhood. The National Hotel in Jackson witnessed much excitement during the fifties, including the hanging from a tree (which formerly stood in front) of an entire gang of Mexican desperadoes who had murdered all of the adult residents in a rooming house on Rancheria Creek. The only survivor of this tragedy was a small baby who was thrown out a second-story window with her throat cut. She recovered, however, and lived to raise a family.

In the center of Jackson, the Carson Pass lateral takes off from the Mother Lode to wind its way up to the top of the Sierra, crossing the summit at elevation 8,650 beyond beautiful Silver Lake and the Carson Spur. This route is along the trail followed by the intrepid Kit Carson, who guided many caravans to California.

BRET HARTE COUNTRY

South from Jackson, the Mother Lode Highway crosses into Calaveras County and up through the famous old mining town of Mokelumne Hill and down again to historic San Andreas and further on to Angels Camp. Through the writings of Mark Twain and Bret Harte the history of this section of the Mother Lode country is more familiar to the average citizen than that of other locations. San Andreas was the site of the famous old Metropolitan Hotel, featured in some of the writings of these two chroniclers of California's golden days. The hotel, however, was destroyed by fire 20 years ago. It was from San Andreas that the gentlemanly, but much feared, lone bandit Black Bart was sent to the penitentiary after a meteoric career as a stage robber.

Angels Camp was another center of turbulent activity during the early decades of the State's existence, from which Messrs. Harte and Clemens derived the material for many of their fascinating tales. It was here that the famous "jumping frog" episode, made immortal by Mark Twain took place. At Carson Hill, a little farther to the south, is located the celebrated Morgan mine, where a $43,000 fortune was found in a single gold nugget.

WHERE MARK TWAIN LIVED

Beyond Melones and into Tuolumne County the highway moves on to Sonora, surrounded by such historical mining communities as Columbia, Rawhide, Jamestown and Chinese Camp. Between the Calaveras County line and Sonora lies the quaint little village





Upper—Jackson, Amador County, still retains much of the color of pioneer days. Lower—On left is famous Hetty Green Mine in Mother Lode.

f Tuttletown; here, a short distance ff the Mother Lode on Jackass Hill is lark Twain's cabin. Mark Twain was known as "The Sage of Jackass Hill" and the old store where he made his daily purchases is still in use.

At Sonora the Mother Lode makes a junction with the Sonora Pass (elevation 9,624) highway which crosses the high Sierra to the east to connect with U. S. 395 between Bridgeport and Coleville in Mono County.

Southwesterly from Sonora the Mother Lode highway follows the Sonora Pass lateral to a point some six miles beyond Jamestown; there it takes off in a southeasterly direction through Chinese Camp, Moccasin, Coulterville and up into the mountains by way of Bagby and Bear Valley to Mariposa. Between Chinese Camp and Moccasin the Big Oak Flat road leads off toward the east and, traversing the northern half of Yosemite National Park, this lateral becomes the Tioga Pass Route over the Sierra. It crosses the divide at elevation 9,941, the highest crossing of the mountains on the State highways,

from which point it twists down to a connection with U. S. 395 near Leevining on Mono Lake. Bret Harte's old cabin is situated near Groveland on the Big Oak Flat Road.

Those familiar with the writings of Bret Harte will readily recall Poker Flat, Poverty Hill, Table Mountain, Whiskey Hill and Jimtown. These historic spots are all accessible from Jamestown.

KINGS RIVER CANYON

In highway development, scenic grandeur is usually accompanied by the heaviest of construction. Probably nowhere has this been better illustrated than in the building of the State highway into Kings River Canyon in Fresno County.

The Kings River National Park in eastern Fresno and Northeastern Tulare Counties embraces an unrivaled wilderness of rugged granite and forest, and the Kings River Canyon leading to the park presents scenery which closely approaches that of Yosemite Valley in massive majesty.

The most direct State highway connecting this wild mountain fastness of California's high Sierra with the outside world is the road between Fresno and the General Grant Grove by way of Squaw Valley. The route leaves General Grant Grove on its northerly boundary and travels along the valley side of the lower Sierra to Cherry Gap. Passing through the Gap the first view is obtained of the rugged beauty of the lower Middle Fork of the Kings. A little further, at Lookout Point, a splendid panorama is had of the massive rock formations of the country along the South Fork and the relative positions of Ten-Mile Creek, the two forks and the main Kings River Gorge.



Windy Cliff, picturesque spot on Kings River Canyon Highway

INSPIRING YUCCA POINT

Winding farther down the grade the highway rounds Yucca Point, an inspiring point of vantage, from which the view of the glacier-carved gorge justifies the name given to the river by the Spaniards in 1805: "El Rio de los Santos Reys" (The River of the Holy Kings). On down over gentle grades and easy curves the highway is carved in the granite of the canyon wall finally reaching the river at Windy Cliff, some 18 miles from the General Grant Grove. Here the rock formation suddenly changes as a great limestone dike rises almost vertically to a height of 1,500 feet above the river. This limestone presents striking examples of natural sculpture. About 200 yards above the highway in the face of Windy Cliff is Patt Boyden's Cave, large galleries and grottoes filled with stalactites and stalagmites through which, from unknown sources, flow strong air currents.

DIFFICULT PROBLEM

Building the highway around Horseshoe Bend presented the most difficult single problem in the road's construction. At this point the highway grade is some 300 feet above the river and its path was blocked by a rugged point of solid granite jutting over the river. While in all the construction of the Kings River Canyon explosives had played a most important part, the high point in operations was the removal in one blast of over 50,000 cubic yards from the face of this rock mass. A coyote hole four to six feet high was drilled along the gutter line of the roadway for a distance of 570 feet. Nine stub pockets were drilled off this tunnel toward the face to provide more advantageous placement of the powder, in all, a total of 735 feet of tunnel was drilled. The charge consisted of 37 tons (74,450 pounds to be exact) of explosive. After the charge had been placed the entire tunnel was carefully packed and backfilled with rock and earth to insure most effectiveness from the blast. In the one shot, 50,500 cubic yards of

rock was moved from the face of the cliff, leaving a solid rock foundation on which to lay the road surface. The westerly 200 feet broke along a vertical seam leaving as clean a bit of construction as could have been desired.

At Windy Cliff, where the highway reaches the river elevation, the road crosses to the northerly side and follows on past Boulder and Grizzly Creeks to Deer Creek Cove where State construction ends. An additional four miles, however, was built by the U. S. Forest Service on to Cedar Grove, where a large area has been cleared among the trees and prepared with camping conveniences.

The State's portion of the Kings River Canyon project covered a distance of 24.5 miles and was built at a cost of $2,300,000, an expenditure which has provided Californians with easy access to some of the Nation's most beautiful mountain country.

SANTA MONICA COAST

When the California coast line was pushed above the tide level much of the shore line consisted of high mesa land leading back to the coastal mountains. Through the centuries, run-off from the mountainous areas cut deep canyons to the sea and the incessant beating of ocean waves broke down the mesa into rugged bluffs and headlands. One of the most characteristic of these locations is along the coast northerly from Santa Monica into Ventura County. Here precipitous bluffs have long stood high above the Pacific with Point Mugu near the Los Angeles-Ventura County line thrusting its rocky chin into the pounding breakers.

The 1919 Highway Bond Issue added to the State highway system a road along the coast between San Juan Capistrano in Orange County and Oxnard in Ventura County. Development of a shore line highway on the 112 miles between these two points necessitated construction along those bluffs north of Santa Monica.

LONG LITIGATION

The southerly portion of the Santa Monica-Oxnard section lay through the famous Rancho Malibu Sequit y Topango. A sizeable volume could be written on the litigation for rights of way through this ranch, which was carried on for years, first by Los Angeles County and then the State. The controversies relative to highway right of way were before the courts of Los Angeles and Ventura Counties for long periods and even were carried to the United States Supreme Court.

First construction on the Malibu section, in 1921, consisted of seven and one-half miles of 20-foot Portland cement concrete pavement. During 1923 and 1924 some grading was done by State forces pending acquisition of rights of way. The next contract, for grading 16 miles through the ranch Arroyo Sequit to Las Flores Canyon, was completed in October, 1926. This contract involved nearly half a million yards of roadway excavation, 125 pipe culverts, 10 concrete box culverts, one 135-foot arch culvert and a reinforced concrete bridge. Under agreement with Los Angeles County three other bridges were constructed across the larger canyons: Malibu Creek, Solstice and Corral. Upon completion of the grading another contract was begun at once for the placing of pavement.

SPECTACULAR WORK

This section of the highway involved no grades of any consequence. Where it was found necessary to leave the beach, the highway leads across a high mesa, overlooking the ocean on one side and the rugged brush-covered Santa Monica mountains on the other.

The most spectacular work between Santa Monica and Oxnard occurred on about 10 miles in the vicinity of Sycamore Canyon and Point Mugu, near the Los Angeles-Ventura County line. Back in 1924 and 1925 initial construction on this 10 miles entailed more than one million cubic yards of excavation, 75 per cent of which was solid rock. At Point Mugu where the entire nose of rocky headland was cut away, over 250,000 cubic yards of material were moved.

At the time of this construction, access to the Oxnard end of the Point Mugu section was easily accomplished over previously completed State work. On the Santa Monica end, however,

On left is Point Mugu where highway swung around cliffs causing traffic hazard. On right is Point Mugu Highway cut which did away with dangerous old road



the situation was quite the opposite; from the end of the seven miles of new pavement out of Santa Monica there were 22 miles of rough mountain road to the construction site. For this reason contractors' camp equipment and steam shovels were brought in by water on ocean scows and delivered on the beach. At the time, these amphibious operations were a dangerous and expensive undertaking and tugboat captains were loath to come in shore unless amply protected and well paid. Landings were, however, accomplished in rather heavy seas without mishap.

DIFFICULT CONSTRUCTION

From a construction standpoint, drilling and blasting operations presented the main difficulties in the Mugu section. It was necessary to build trails over the hills to the edge of the cliffs and to provide ropes, ladders and platforms to make the face of the bluffs accessable for tunneling. Coyote holes were driven from the face to the inside gutter line of the proposed roadbed and smaller cross-tunnels ending in large explosion pockets were drilled from the coyote holes about every 30 feet. Explosive charges amounted to as much as 6,250 pounds of black powder in a single pocket and often a single blast comprised 80,000 pounds. After the charges were in place the problem of backfilling presented difficulties and in some instances it was necessary to lower material in buckets down the face of the cliffs to tunnel portals.

The roadbed section along the base of these bluffs cut through the hard igneous rock which formed the face and at irregular intervals intercepted soft interior rock of sedimentary origin. This made blasting a delicate and uncertain matter. At one time the powder foreman, a man of years of experience and unquestioned ability, misjudged how far back one of his large blasts would break. The top of the cliff, 150 feet above the explosive charge, broke some 60 feet back of the slope stakes and carried away the ground on which the foreman and two helpers, who fired the shot, were standing. It is unbelievable that they could have gone down 200 feet to the very surf with that mass of moving rock and live, but fortunately all three escaped death.

DANGEROUS WORK

The engineers on survey parties working ahead of the drillers felt that the contractor had no corner on hard and dangerous work. Scaling perpendicular cliffs and dangling from ropes high above the pounding breakers were all part of a day's work for them as well.



Scene on Santa Monica Highway showing precipitous bluffs which engineers had to overcome

Since the days of those pioneer contracts in the early and middle twenties, development of this highway has gone a long way. Further construction, reconstruction, widening and straightening during the past twenty years have evolved this route into a modern thoroughfare, four lanes, divided, over southerly end. Prior to the war and its curtailment of recreational driving this coastal highway carried some of the heaviest traffic on the State highway system, summer Sunday counts in several years reaching to 37,000 cars in sixteen hours. Sixteen years ago, when the route was a two-lane highway, 53,303 cars were recorded in sixteen hours at the Santa Monica Canyon intersection on July 14, 1929—the State's highest record for rural traffic density.

FIGHT AGAINST OCEAN

Another interesting construction feature used by the State in developing this route involved protection of the roadbed from the force of the surf. For six or eight years after the highway was constructed, the constant wave action north of Santa Monica Canyon gouged into the shelf upon which the highway was built. If nothing had been done about it the ocean would have undoubtedly swallowed the highway and begun again its age-old task of tearing down the bluffs.

That highway was an important link in the State road system; it represented an investment of millions in public funds; the people wanted it, they needed it, and for $30,000 it was saved to them, together with a new stretch of sandy beach nearly a mile long and 200 feet wide.

The method used to protect the highway and build up the beach was not new in engineering practice; it consisted of constructing five sheet piling walls (technically known as groins) at right angles to the shore line. These groins were placed about 500 feet apart and extended into the surf some 200 feet. As far as man's effort was concerned that was all there was to it.

The ocean did the rest and within twenty months built up a fine sand beach for a distance of more than 3,300 feet along the shore. Without going into details, the theory of this method is to break up the cross currents along the shore, known as the littoral drift, with the result that sand carried by the water is dropped and washed ashore by incoming waves. The method, while not applicable to all locations, was most successful in this instance and added a recreational spot of inestimable value to southern California.

TORREY PINES GRADE

Just fifty years after Columbus sailed his galleons across the Atlantic Cabrillo dropped anchor in San Diego Bay and was the first white man to set foot in California. It was not until 200 years later that the first mission was erected and the pueblo of San Diego established around it—the first city of California.

From this beginning, Father Junipero Serra started the development of California. His chain of missions, each a day's journey apart, extended northward along the El Camino Real. Over this rough, dusty, but nonetheless royal, highway plodded the sandaled feet of Franciscan padres, marched steel-helmeted conquistadores and rode swaggering vaqueros.

That part of this forerunner of the State highway system immediately north of the pueblo of San Diego lay upon the flat mesa which extends back from the bluffs along the ocean shore. At Sorrento Creek, where the stream had cut a canyon through the mesa, the trail twisted and turned down the face of the bluff to sea level through a cluster of tall, windswept trees, the only grove of Torrey Pines. For over a hundred years, access between the level of the ocean at the mouth of Sorrento Creek and the top of the mesa was down this steep and twisting road and highway which evolved from the old trail of the Franciscans.

This section of U. S. 101 did away with old Torrey Pines Grade in San Diego County



WORK COMPLETED IN 1932

It was not until some twenty years after the First State Highway Bond Issue that statutes governing development of the State highway system were liberalized to permit participation by the State in the improvement of State routes through cities and, though the notorious Torrey Pines grade lay upon the trunk route between San Diego and Los Angeles, it was within the city limits of San Diego and outside the jurisdiction of the Division of Highways.

During the late twenties the city of San Diego began a planned development of important city streets and highways which included the relocation of the old State route to the north. This change provided a shift to Rose Canyon on the easterly side of the mesa and a complete relocation of the Torrey Pines grade. With the change in State highway laws, the Rose Canyon project was built by the city with the financial cooperation of the State. With further legal changes permitting the Division of Highways to improve its routes within cities, the State and the city jointly took on the project of relocating the Torrey Pines grade. In 1932 the work was completed.

At this time when jurisdiction of urban State routes was invested in the Division of Highways, the Torrey Pines grade was notorious as one of the most tortuous and dangerous grades on any major State highway and its elimination from the State system was of inestimable benefit to traffic. The new alignment provided for a long and relatively straight grade out of the Sorrento Creek canyon to the top of the mesa, on a line east of the old grade.

TREES SAVED

Incidentally, the contract which provided for paving the new highway also provided one of the first four-lane

(Continued on page 32)

Bridge Maintenance Practice On California Highway System

By KENNETH ELDER, Assistant Engineer

THERE are 4,636 bridges on the California State Highway System omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is $125,000,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenance and Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the sixth. It deals with Improving Clearances on Highway Structures.

ONE major portion of work done in connection with the widening of numerous State Highway bridges has been done by contract; however, in many instances bridge clearances can be greatly improved by relatively minor alterations. These minor alterations are usually accomplished by the maintenance forces and this article will deal with such minor work.

Structures on the present State System classified as bridges, exclusive of underpasses, tunnels, and overcrossings, fall under any one of the four following classifications:

1. Concrete and steel structures of 10-foot span or over, excepting those of less than 20-foot span which have a depth of fill over them greater than the span length.

2. Timber structures of three feet or greater total span and two feet or greater in height; excepting those of less than 20-foot span where the fill over them is greater than 1.5 times their span length.

3. All structures which, measured parallel to roadway center line, have a length of more than 20 feet between the inside faces of end abutments. (This class conforms to the records of the Public Roads Administration and the State Planning Survey.) About 3,500 of 4,377 strictly bridge structures have spans of greater than 20 feet.

4. Any structure which, in the opinion of the engineer, creates a traffic hazard, or has some special feature requiring regular investigation. About 2,400 structures have roadway widths which are less than the present

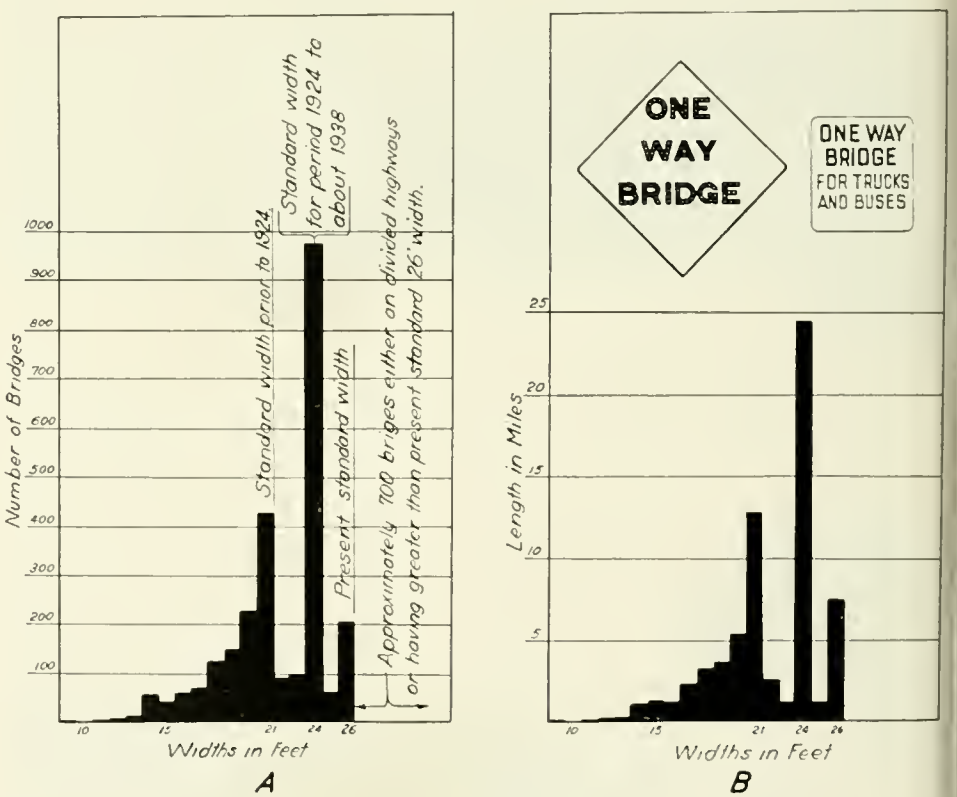


FIGURE NO. 1

standard width of 26 feet. They can be grouped according to their roadway widths as shown in the graphs in **Figures 1A and 1B. Figure 1A** shows the number of bridges in each group and **Figure 1B** the roadway mileage in each group.

NARROW BRIDGES

The standard width for bridges carrying two-lane traffic in California prior to 1924 was 21 feet. This was changed in 1924 to 24 feet. The present standard roadway width is 26 feet and is based on two 11-foot lanes with an additional two-foot strip on either side. The need for this width is shown by the fact that the California Motor Vehicle Code allows a maximum overall width of 100 inches on all vehicles and 120 inches on certain types of special equipment.

There are many narrow structures on the State System, the widening of

which is impracticable or unwarranted because of the cost. Advance notice of such condition, in the form of warning signs, is considered expedient. Two types of warning signs have been adopted for this purpose. All bridges having a clear roadway width between 20 feet and 16 feet have advance signs reading "One Way Bridge for Trucks and Buses." Those structures whose roadway width is less than 16 feet have advance signs reading "One Way Bridge." **Figure A** shows signs of these types.

Such signs have, no doubt, been instrumental in reducing accidents at these structures and are considered well worth their cost.

WIDENING COST HIGH

Structures having widths less than 20 feet are usually situated on roads carrying a relatively small amount of traffic and seldom can be widened without complete reconstruction because of their generally light design and poor condition. However, some are situated on roads carrying a relatively large volume of both heavy and light traffic and these present a considerable hazard.

The cost of widening all the narrow bridges to the present standard width of 26 feet would be at least $5,000,000.

It would be desirable to do this, but because of the large expenditures necessary to take care of structurally weak bridges and other more urgent work, much of it will have to be deferred indefinitely. In the meantime, we are faced with high maintenance and repairs to the many bridge rails on such structures that are continually damaged by vehicles.

There are many through steel trusses on the State System with narrow roadways which, for the most part, have been inherited from the various counties. Proper widening of this type of bridge is generally impractical and the cost of replacement is relatively great.

SERIOUS BOTTLE-NECKS

These structures constitute a serious "bottle-neck" in many places and they have caused accidents which have been expensive to the State, to the owners of the vehicles and therefore to the traveling public at large. It has been observed that in such cases heavy, wide vehicles, in order to avoid risk of striking the rail or curbs, encroach on the opposing traffic lane. **Photo No.** indicates this condition, it being one of considerable hazard on heavy traveled roads. **Photo No. 1a** shows the result of a very serious accident which occurred on a narrow steel truss when two vehicles, in attempting to pass, caused extensive damage to several critical members of the structure. Deducting the width of the two vehicles from the roadway width, only 7½ inches was left for passing clearance.



Other similar accidents have resulted in the breaking up of one or more members with a resulting partial failure of the structure. It is one of the unsolved mysteries of the age why some simply supported trusses, which have been badly damaged in this manner, continue to function under heavy loads.

RAILS DAMAGED

Rails are severely damaged when curbs are so narrow that they offer insufficient room for overhang. **Photo Nos. 2 and 2a** show cases of this kind where large portions of the railing have been torn out. In the case of the bridge shown in **Photo No. 2a** 70 posts out of a total of 96 were replaced at least once and some of them as many as four times. **Photo No. 2b** shows the set up on a narrow bridge with low ineffective curbs. Forced by opposing traffic to stay in his narrow lane the truck is crowded against the rail and overhanging width causes the damage noted above. Often the front wheel hooks into the rail with resulting loss of control and the entire unit may crash through the rail. **Photo No. 2c** shows such an accident.

Various methods have been devised for alleviating the conditions above described. **Figure No. 2** shows details employed in removing the railing and placing new substantial curbs in their place. A new railing is then attached outside this curb. While the actual gain in roadway width in this particular case was only 10 inches, the additional gain in width between rails was two feet two inches. This was a very substantial gain for overhang, a lack of which has caused considerable dam-





age to bridge railings. Observations made on one structure before this was done, showed that all vehicles crowded into the opposing lane. After widening by method shown in **Figure 2**, it was found that traffic moved closer to the curbs and even rubbed them without hitting the rails. **Photos Nos. 3 and 3a** show a structure before and after the new curbs and rails were placed as detailed in **Figure No. 2.**





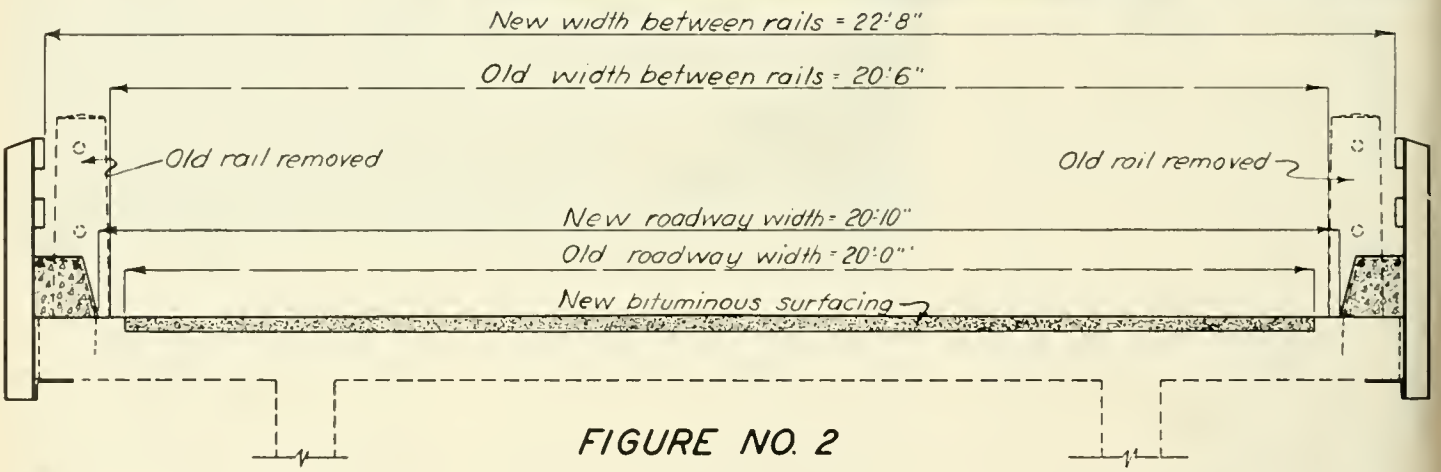


FIGURE NO. 2

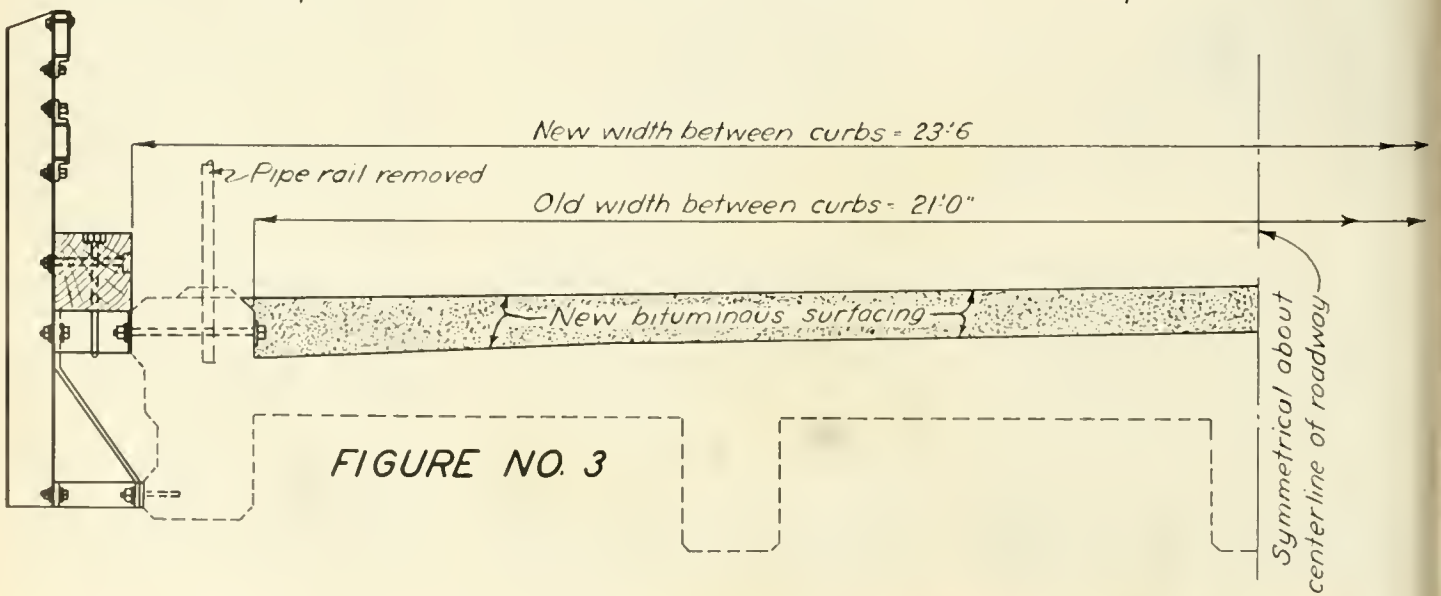


FIGURE NO. 3





SUCCESSFUL METHOD

Figure No. 3 shows a method which has been successfully adapted to a type of construction quite frequently found on many bridges. New curbs and rails, mounted on brackets, are bolted to the outside girders and the floor leveled up by placing additional wearing surface. This method can only be employed when the structure is strong enough to carry the additional load and it is permissible to raise the grade line as shown. **Photos No. 4 and 4a** show a completed job as detailed in **Figure 3.**

Figure 4 shows another method which has been used in several cases when nothing better was practicable. The old rails were removed to top of curbs and new ones bolted to the outside of the girders. While this method shows no gain in roadway width, there is considerable gain in overhang clearance between the front faces of the curbs and the railings. There is a feeling of more ample width which causes vehicles to stay close to the curbs. **Photos No. 5 and 5a** show before and after pictures of this type of widening.

WINGWALLS COMMON PRACTICE

When a superstructure is in exceptionally poor condition and the design and condition of the substructure warrants its use for a new one, it is common practice to remove the floor, respace the stringers, or add new ones, and construct a new floor, curbs and rails. In this case the 45-degree wingwalls were substantial and could be encroached upon for support of new but longer outside lines of stringers to gain the extra width desired.

Most narrow bridges are, naturally, located on substandard, narrow roads and often have rather sharp curves at the bridge approaches. Narrow "through" structures on such set-ups should be protected from overhanging loads by wide and substantial curbs. It has been argued that wide curbs cut into an already narrow roadway but, paradoxically, such a reduction improves the "effective" roadway width, since with wide curbs, traffic feels safe in crowding over directly against them thus leaving much more room for opposing vehicles than otherwise would prevail. This contention has been proved in quite a few instances where this method has been adopted. Such curbs on narrow structures pay for themselves at all such locations.

Impaired vertical clearance on some of the "through" structures has been





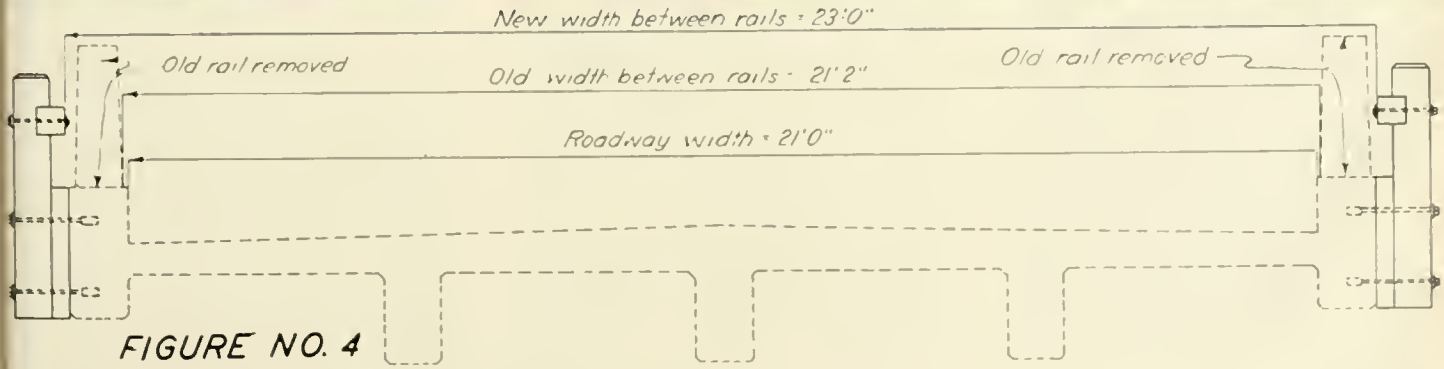


FIGURE NO. 4

a source of considerable hazard and expense. The bridge maintenance article appearing in the May-June issue of 1945 of CALIFORNIA HIGHWAYS AND PUBLIC WORKS on Repair of Steel Trusses, touched on this matter and showed what could be done to alleviate troubles of this nature.

The State Motor Vehicle Code limits the legal height of vehicles to 13.5 feet. All "through" structures of recent construction have been designed for a vertical clearance of not less than 14 feet and on main highways 15 feet clearance is usually provided. However, there are 41 structures now on the State Highway System with a vertical clearance of less than 14 feet, the lowest of these being an underpass with clearance of only 9.9 feet. Nearly all of these impaired structures were built by agencies other than the State, previous to taking the road into the Highway System.

In a few important locations the clearance at underpasses has been improved by lowering the roadway grade. As previously described, quite a few "through" bridges having impaired clearance due to knee braces at the portals and intermediate frames, have been improved by removal of these braces. Strengthening of the structure by the addition of plates at critical section is necessary to retain the structural capacity. Much damage has occurred on structures having reduced clearance at the side due to knee braces. Expenditures to correct this condition have been considered to be well worth while.

Records of damage to such structures indicate that this kind of trouble is rapidly becoming a common occurrence. Truck traffic is developing by leaps and bounds and maximum legal heights of vehicles and over-height loads can be found on all types of roads throughout the country. Impaired clearances must be improved to the legal maximum, at least, if damage from this cause is to be avoided.

Some of the more common methods of widening to gain either additional roadway width or overhang clearance have been explained in this article. Generally, as explained at the beginning of this article, the most desirable way to attain this end is to either replace the superstructure with a new and wider one, or remove the curbs and rails, widen the roadway slab and place new curbs and rails. However, it is not always desirable or possible to do this.

Results to date clearly indicate that accidents have been reduced and maintenance costs materially decreased in cases where these types of improvements have been used.



In Memoriam

Leslie Taylor McNamara

District VI lost a trusted employee and a valued friend in the untimely passing of Lt. Col. Leslie Taylor McNamara on August 27, 1945, at the age of 42 at Hammer Field Hospital, Fresno.

Col. McNamara was an Assistant Highway Engineer when he was granted military leave in 1941 from the Division of Highways. Previous to that year he was a member of the California National Guard for more than ten years and became a Captain with the 185th Infantry. He transferred to the Corps of Engineers after being assigned to duty in the Aleutian Islands and saw action on Attu and Kiska. He was last stationed on Amchitka from which island he was sent to Fitzsimmons Hospital in Denver for treatment of a chest ailment. An operation failed to arrest the disease and he was returned to his Fresno home in the latter part of August and subsequently taken to Hammer Field Hospital.

Born in Houghton, Michigan, he graduated from the Michigan School of Mines and Technology. He gained experience in mine surveying in Arizona, and in irrigation facility design with San Francisco firms and with the California Water Service Co. Several years were spent with the U. S. Engineers at Stockton.

He started work with District VI, Division of Highways, in March, 1929 and was employed continuously up to the time of leaving for military duty. His assignments included both office work and construction.

He is survived by his widow, Mrs. Grace F. McNamara; a son, Peter, 11, and a daughter, Leslie Ann, 3, and his parents, Mr. and Mrs. P. A. McNamara of Houghton, Michigan.

Former Highway Commissioner is Called by Death

From one end of California to the other, men and women in public and business life who knew Philip A. Stanton are mourning his death, which occurred at his home in Seal Beach on September 8th.

Born in Cleveland, Ohio, February 4, 1868, Mr. Stanton came west at the age of 18 years, arriving in Anaheim, Orange County, with a capital of $18. Mr. Stanton entered politics as an Assemblyman in 1903 and in 1909 was elected Speaker of the Assembly, a position he held for four successive terms. In 1910, the year Hiram Johnson was elected Governor, he was one of several unsuccessful Republican candidates for the gubernatorial office. He was California's Republican National Committeeman from 1912 to 1916.

Retiring from active participation in politics, Mr. Stanton founded three southern California cities, Huntington Beach, Seal Beach and Stanton. In 1930 he returned to the political arena and campaigned for James Rolph, Jr., for Governor. Upon assuming office, Governor Rolph appointed Mr. Stanton a member of the State Highway Commission, a position to which he was reappointed by Governor Frank F. Merriam.

CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

San Miguel Arcangel
July 25, 1797

FATE elevated Mission San Miguel Arcangel to the heights of happiness and prosperity in the early decades of Franciscan administration and then flung it into depths of degradation and tragedy during the years of its decline under Mexican misrule in California and the turbulent period following American occupation. However, the spirit of its old padres never entirely deserted the Mission and the latter part of the nineteenth century saw its resurrection and later its gradual restoration to its present state.

Eleventh of the Franciscan stations on El Camino Real, south to north, San Miguel Arcangel, "The Mission on the Highway," was the sixteenth founded. Father Presidente of the Missions Fermin de Lasuen, who succeeded Father Junipero Serra, himself blessed the site and raised the cross for the mission on July 25, 1797, at a place on the Salinas River called by the Indians Vahca, by the Spaniards Las Pozas and known today as San Miguel, 12 miles north of Paso Robles in San Luis Obispo County.

Upon his arrival with Gaspar de Portola in San Diego in July, 1769, Fr. Serra had visioned a chain of missions stretching from there to San Francisco and each a day's journey apart, but 11 years after his death there existed in 1795, a gap between Mission San Luis Obispo and Mission San Antonio de Padua in what now is Monterey County. In the summer of that year, Governor Diego Borcia, desiring to close this gap, sent out an expedition to search for a new mission site, and with this party went Father Buenaventura Sitjar of Mission San Antonio.

NAME IS CHOSEN

Fr. Sitjar, after careful explorations, chose a spot near the hot springs of Paso Robles, used in that day by the Indians and now known far and wide for their medicinal virtues. Fr. Lasuen reported the findings of Fr. Sitjar to Governor Borcia and the latter petitioned Viceroy Branciforte in Mexico for permission to establish a mission on the site. The Viceroy gave his approval, saying: "I have resolved that the patron should be San Miguel, Arcangel."

And so it was that Fr. Lasuen, founding the mission two years after Fr. Sitjar's report, dedicated it in honor of "the most glorious Prince of the Celestial Militia, Archangel St. Michael."

The work of the padres at San Luis Obispo and San Antonio had become known to the Indians in the country between the two stations so that when Fr. Lasuen arrived to found San Miguel, the natives assembled at the site in great numbers. In musty but legible ancient records one may read in Fr. Lasuen's handwriting that "the many pagans who had flocked together and were present during the whole function offered 15 of their children, and with such ardent desires that they be made Christians, that I had to solemnly bless the Baptismal Font. Then in the same enramada (arbor) which had served that morning for the celebration of the holy Sacrifice of the Mass, I solemnly baptized Miguel Maria."

Miguel Maria was the first of 11 boys and three girls the good padre baptized that afternoon of July 25, 1797.

FRIENDLY INDIANS

The Fr. Presidente left Fr. Sitjar and Fr. Antonio de la Concepcion Horra at the new mission and the priests, with the aid of the friendly Indians, immediately set themselves to the task of constructing a church and dwellings for themselves and the neophytes.

Four weeks after the ceremony of dedication, Fr. Horra became violently insane and frightened the natives and guards alike by his mad behavior. Historians attribute the loss of his mental faculties to extreme summer heat. The poor friar was taken to Monterey, pronounced incurable and sent back to Mexico.

The annual report of December, 1798, states that the temporary church was replaced by a more permanent edifice at the end of 1797.

The building operations progressed steadily and in 1805 we find the padres adding 17 adobe huts to their community and turning out 10,000 tiles to roof the mission and other structures.

Fathers Sitjar and Horra were replaced by Father Juan Martin and Fr. Baltazar Carnicer and in a report dated December 31, 1804, Fr. Martin

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into northern Washington.

Present day State highways lead to all the mission sites. Now that the war is ended, California looks forward to again welcoming tourists from all over the world. With the resumption of normal automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways is publishing in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions are taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the seventh of the series.



Beautiful Mission San Miguel Arcangel as the tourist sees it today

states that the mission community numbered 466 male and 462 female Indians. During 1803-04 more than 440 natives of all ages had been baptized, and by the end of 1804 the baptisms totaled 1169.

PADRES POISONED

Fr. Martin and Fr. Carnicer had a terrifying experience in January, 1800, when an Indian who resented discipline, in some manner succeeded in poisoning both of them. Fr. Francisco Pujol, who came from Mission San Antonio to nurse them, also was given food that contained poison and succumbed, but his two patients recovered.

In 1806 a fire destroyed two rows of mission buildings containing 6,660 bushels of wheat and damaged the roof of the church considerably. It was decided to erect a new house of worship. Father Presidente Estevan Tapis, who had succeeded Fr. Lasuen, called upon the other California missions to contribute provisions, clothing, church goods, etc., to San Miguel and all responded generously. Building activities increased yearly and in 1816 stone foundations were laid for an imposing church.

The padres at San Miguel, in common with their brothers at the other missions, longed to establish a station in the wild country of the Tulares, to the east, inhabited by warring savages. So, in November, 1804, Fr. Martin, with only two soldiers, bravely set out inland. He had difficulty overcoming the fears of the natives, hundreds of whom fled upon his approach, but he finally won them over and returning, reported that he had found "4,000 Indians all of whom would be lost by dying away ignorant of their eternal destiny, because Satan, wars and diseases would leave no one to be converted." He urged that a mission be established for the Tulares. Opposed by the Mexican civil government, the Franciscans never saw their dream of missions in the interior realized.

SAVAGE TULARES WOOED

In October, 1814, 10 years later, Father Juan Cabot of San Miguel led another expedition into the Tulares, baptizing many aged natives. Old mission records reveal that Father Martin and Cabot reaped some rewards for there are frequent notations of the baptisms of members of the savage Tulares, who voluntarily followed the padres back to the mission.

The new stone church was completed in 1818 and in 1821 its interior was painted and frescoed by Esteban Munras, Spanish artist of Monterey, some of whose artistic work may be seen at San Miguel today.

Happy days at San Miguel approached an end with the arrival in California in 1825 of Governor Jose M. Echeandia, enemy of the missionaries, who laid the groundwork for the eventual seizure and destruction of the California missions by Mexican politicians. On January 6, 1831, Echeandia issued his decree secularizing the missions in spite of the fact that his appointed successor, General Manuel Victoria, even then was enroute to Monterey to take over his office. Echeandia lost no time. He appointed Jose Castro commissioner to go to San Miguel with Juana B. Alvarado, Jose Maria Villaviceno and Jose Avila and inform the Indians that they were "free."

On January 7th, Alvarado, as he later related, assembled the neophytes at San Miguel and instructed those who wished to remain with the padres to "stand to the left and those who wished freedom to stand to the right." Nearly all the Indians stood to the left, saying they desired to stay with their missionary guardian, and then the others joined them.

San Miguel was confiscated by decree of the civil government on August 9, 1834. A salaried administrator was placed in charge and the mission was declared a curacy of the second class by the territorial assembly. Father Juan Cabot, who had served at San Miguel for 21 years, and for 30 years with the California missions was penniless and asked Governor Figueroa for money to return to Spain. He was given $400. His brother, Fr. Pedro Cabot of Mission San Antonio, succeeded him. He refused the title of curate and would accept no compensation. On July 14, 1836, the mission was delivered to Ignacio Coronel, who had been appointed administrator. Father Juan Moreno remained at the mission until 1840. In 1838, he complained bitterly that there was no food or clothing for himself and his Indians.

An inventory taken in 1837 placed a valuation of $82,806 upon the mission and its property. To what sad state the mission fell in a few years is indicated by a report on every mission in California which the Mexican Government required Father Perfecto Duran to draw up in 1844. Reporting on San Miguel, under date of March 18, Fr. Duran wrote: "Mission San Miguel Arcangel is today without livestock, and the neophytes are demoralized and dispersed for want of a priest to care for them."



Byron Dome Photo

Restored chapel of Mission San Miguel looking as it did in the days of the Founding Padres

On October 28, 1945, Governor Pio Pico forced his assembly to decree the sale of all missions and, as we have seen, proceeded to sell the Franciscan stations wholesale. San Miguel was the last one sold. It was disposed of by Pico to Petronillo Rios and William Reed on July 4, 1846, just three days before the American Flag was raised at Monterey and Pico fled the country.

September 2, 1859, President James Buchanan returned San Miguel to the Catholic Church, all of Pico's mission sales having been declared illegal by the United States District Court.

After taking over the mission, Reed and his family took up their residence there. One year later he and his wife, his three-year old son, his wife's brother, Jose Ramon, Josefa Olivera, a midwife, and her daughter aged 15, and nephew, aged four, an Indian servant and the latter's five year old nephew, and a negro cook, were brutally murdered in their quarters.

It seems that in December, 1848, a party of five men stopped at the mission and were entertained by Reed, who unwisely boasted of having considerable gold. Leaving their host, presumably to continue their journey south, the ruffians returned after dark, killed all the occupants of the mission and fled with Reed's gold and other valuables.

Soldiers from Santa Barbara overtook them near Ortega Rancho, killed one of them, forced another, Samuel Brenard, to jump into the sea, where he drowned, and took the surviving three back to Santa Barbara for trial. They were executed on December 28, 1848.

LAWLESS BANDS TAKE OVER

"The discovery of gold early in 1848," say Fr. Engelhardt, mission historian, "attracted all kinds of adventurers and fortune hunters to California. Being situated on the highway between Los Angeles and



The gardens of Mission San Miguel provide an added touch of beauty

San Francisco, the deserted mission buildings of San Miguel in consequence became the refuge of wanderers, gamblers, drunkards and outlaws. A saloon occupied one of the ancient reception rooms, whilst on the other side of the main entrance the apartment probably occupied by the resident missionary in the days of mission activity, served as a sample room and agency for a popular sewing machine. The church fortunately was respected and preserved from desecration at the hands of the lawless bands that infested the country."

These conditions prevailed until 1878, when Bishop Francis Mora appointed the Rev. Philip Farrely resident pastor of San Miguel and its dependencies, including Paso Robles. A new and happier era for San Miguel began. Fr. Farrely and his successors through the years patiently set to work to restore the old mission. The centennial of the founding of San Miguel was celebrated with a three day festival arranged by Fr. Henry S. O'Reilly, September 28, 29 and 30, 1897. And in 1901 the main building of the mission with its many apartments was renovated.

On November 13, 1912, marble slabs placed over the tombs of the Franciscan missionaries, Fr. Marcelino Cipros and Fr. Juan Martin, who lie beneath the church were unveiled and blessed at an impressive ceremony attended by many church dignitaries.

In 1928, Rt. Rev. John B. MacGinley, Bishop of the Diocese of Monterey-Fresno, offered San Miguel and Mission San Antonio to the Franciscan Provincial of Santa Barbara Province, his offer was accepted and in August of that year, two fathers and a lay brother took possession of San Miguel. Small donations from visitors and other contributions were used to improve the old mission and today it is one of California's cherished and revered spots of historic value.

Mission San Miguel is easily reached by motorists, being on the Coast Highway, U. S. 101, in the City of San Miguel. Motorists from the south, after leaving San Luis Obispo and the mission of that name there, proceed north through Santa Margarita, Atascadero, Templeton and Paso Robles direct to San Miguel. Those who take the inland route from Southern California will turn west from Bakersfield over the Cholame lateral to Paso Robles and go 12 miles north to Paso Robles.

Coming south from San Francisco, the way is over U. S. 101 direct to San Miguel or down the San Joaquin Valley to Hanford, thence southwest over the Yosemite-to-the-Sea Highway to Cholame, thence west to Paso Robles and north to San Miguel.

Nuestra Senora de la Soledad
October 9, 1791

THIRTEENTH of the Franciscan stations established in California, Mission Nuestra Senora de la Soledad endured many trials and tribulations and came to an unusually sad end.

Its isolated location, lack of true missionary spirit on the part of its first resident padres and the dire privations its priests and Indian neophytes suffered under Mexican civil and military governments accounted for its rather tragic history.

Dedicated to Most Holy Mary, Our Lady of Solitude, the mission was given the name of Soledad, the origin of which is not definitely known. Fr. Engelhardt, mission historian, quotes Fr. Pedro Font, chaplain of Captain Juan B. Anza's expedition, which discovered the first overland route from Sonora, Mexico, to San Francisco, as offering the best explanation.

Anza stopped at Soledad on his journey and recording the visit in his Journal, Fr. Font, on March 9, 1776, wrote: "We stopped at a place called Soledad, and they told me that it was thus called because on the first expedition of Portola (September, 1769) they asked an Indian his name, who answered Soledad, at least it sounded that way to them."

MISSION FOUNDED

Fr. Fermin Francisco de Lasuen, who succeeded Fr. Serra as Presidente of the California Missions, himself founded Mission Soledad on Sunday, October 9, 1791. He was assisted by Fr. Buenaventura Sitjar of Mission San Antonio de Padua, and Fr. Diego Garcia.

Authorization to found Mission Soledad came to Fr. Lasuen from Viceroy Reville Gigedo of Mexico on August 2, 1790, on the same ship that brought to Monterey four Franciscan missionaries assigned to service in California. Church goods that were to have been shipped on the same vessel failed to arrive and in a circular issued July 22, 1791, Fr. Lasuen called upon the other missions to contribute what they could to Soledad. This they did gladly, whereupon Fr. Lasuen proceeded to Soledad and established the new mission.

"This place, then, is constituted a Mission dedicated in honor of the Most Sorrowful Mystery of the Solitude of Most Holy Mary, Our Lady," wrote Fr. Lasuen in recording the founding of the station. "In virtue of the faculty received from the Apostolic College of the Propagation of the Faith of San Fernando de Mexico, I named as its first missionaries the Rev. Fathers Preachers Apostolic, Fr. Diego Garcia of the Provincia de Los Angeles, and Fr. Mariano Rubi of the Provincia de Mallorca."

BAD CHOICE OF PADRES

After four months, Fr. Garcia was transferred to San Antonio and Fr. Bartolomi Gili was sent to Soledad.

The selection of Fr. Gili and Fr. Rubi to be the resident missionaries at Mission Soledad was unfortunate. Fr. Engelhardt, historian, has this to say about the two priests:

"Two friars were in charge who had made a bad record for themselves in Mexico, nor should they have been allowed to proceed to California, of all places where such characters could be least acceptable. Unfortunately for the good name of the Missionary College of San Fernando de Mexico, Viceroy Manuel Antonio de Flores, for reasons not divulged by him, held a protecting hand over them when they should have been expelled. * * * * He objected to the expulsion of the two men who wore the garb of Franciscans, but behaved like hoodlums while at the seminary of San Fernando."

Fr. Engelhardt treats of the subject of these two friars at some length because their conduct reflected upon the splendid records made by all the other Franciscan padres in California. He says, quoting Fr. Pangua, that the situation hastened the death of Fr. Guardian Palou, who "found nothing else to do than weep like a child, and from fear locked himself in his cell."

PLAGUE KILLS INDIANS

Fr. Engelhardt gives the two priests credit for behaving themselves at Soledad, but regrets that both lacked missionary spirit, complained of their surroundings and hardships and did not set a good example in faith and pati-

This photo taken fourteen years ago showed then the rapidly disappearing ruins of Mission Soledad



Byron Dome Photo



This is about all that remains of the once proud Mission Soledad

ence to the Indians. Nevertheless, they enrolled numerous converts during their year at the mission. Fr. Rubi was sent back to Mexico in January, 1793, and the following month Fr. Garcia was recalled from San Antonio Mission. A year later, Fr. Gili returned to Mexico.

On December 31, 1800, Soledad had 1,000 cattle, 3,000 sheep and 64 horses, and the Indian community consisted of 521 souls. In 1802, an epidemic, the nature of which is not known, caused the death of many Indians. Notwithstanding all the difficulties that beset Soledad, Fr. Engelhardt says that the mission population increased until 1805, when it reached the highest mark in its history with 688 neophytes. After that, he adds, for lack of savages to convert and owing to diseases communicated by Mexican soldiers, the Indians community dwindled so that by 1810 it had the smallest number of converts of all the missions except San Carlos.

GOVERNOR AIDS

Governor Jose Joaquin de Arrillaga, great friend of the Franciscans, while on a tour of inspection in 1814, was taken ill and hastened to Mission Soledad to be near Fr. Florencio Ibanez. There he died on July 24. He was given burial beneath the chapel, an appropriate resting place for the man whose term in office has been called by Fr. Engelhardt the "Golden Age of the Missions."

Following the revolt in Mexico against Spain the burden of feeding and clothing the soldiers of the California garrisons was placed upon the missions, the Mexican Government having stopped shipments of rations, clothing and pay to the military. Wherefore, Governor Jose de Arguello wrote to Fr. Vicente Francisco de Sarria, commissary prefect of the Franciscans, that the soldiers of the presidios of San Francisco and Monterey and their families were destitute, and asked for flour and blankets for them.

Fr. Sarria requested the missions to make contributions and Fr. Antonio Jayme at Soledad gave 5,000 pounds of flour and some clothing. A year later, January 5, 1816, Mission Soledad again was called upon for woolen cloth. So poor was it that Fr. Jayme replied that wool was scarce at Soledad, but that he would "beg some from the other missions." He managed, somehow, to forward 25 blankets, made by his Indians, to Monterey.

ELECTION HELD

The Mexican government demanded that its subjects in California swear allegiance to the new republic and on May 5, 1822, the padres at Soledad and their Indian wards held a meeting and took the oath of independence. They were authorized to elect a representative for the electoral convention at Monterey which would choose a delegate to the Mexican Congress. The record of the election at Mission Soledad, the first and last accorded the Indians, makes interesting reading. It follows:

"At the Mission of Our Lady of Soledad, this day, Sunday, November 19, 1826, the chief Alcade Geronimo, last night summoned the people to come to church. All being assembled, we attended our holy Mass and commended ourselves to the Blessed Virgin to give us a good heart that we may do what the commandante of the presidio has directed us to do. After hearing holy Mass, we went out of the church, and being together with the people, I named Senor Simon Cota, who can write, as my secretary, and I chose two Scrutators, Odilon Quepness and Felipe de Jesus. Then out of all the people 11 were set apart as the commandante prescribed, whereupon all the people retired except the 11. They talked among themselves whom of all the men of the mission they should send to Monterey. Three wanted Fernando, one was in favor of Isidro, two preferred Valentin, and four Juan de Dios. Then all 10 concluded that Juan de Dios was the man whom God desires to go to the commandante of Monterey, and hold himself subject to his orders. And this is to be known by all the people, and this paper we all that are here present will sign, affixing thereto a Cross because we cannot write; and Juan de Dios will carry it with him. Before me, Simon Cota, Secretary of the Junta."

Reports kept at Soledad by the resident padres were not as informative as

(Continued on page 26)



Students From Far North to the Far South Study Road Building Here

ONE day recently, the Materials and Research Department was host to foreign students from the far north to the far south in search of information regarding California Highway practices. The visitors were all traveling on independent assignments and just happened to visit the laboratory on the same day, their visit following by several weeks the visit of four Chinese students who recently spent three weeks with the Materials and Research Department.

The most recent visitors are shown with Thomas E. Stanton, Materials and Research Engineer, third from left, and are: Haraldur Asgeirsson of Rekjavik, Iceland, engaged in studies for the Iceland Government Ministry of Industries; Joaquin Rasgado of Brazil, employed at the laboratory in cooperation with a program carried on through the International Training Administration, Inc., a project of the Office of the Coordinator of Inter-American Affairs; Edmundo Sisto (Columbia University Scholarship), Montevideo, Uruguay. Sisto was formerly a District Engineer in the Department of Highways in Uruguay. He will return to his country as head of the Soils Laboratory; Oreste Moretto, extreme right, Buenos Aires, Argentina. University of Illinois Graduate Fellowship under the auspices of the Institute of International Education in the program of providing good will between the two countries, studying for a Ph.D. in Civil Engineering and in that connection touring the United States studying highways, structures, and soil mechanics. A member of the staff of the Argentine Department of Public Works.

The following Chinese Students recently spent several weeks in the Materials and Research Department. The first four were from China and the last, Clarence Seid, is an employee in the Design Department of the California Division of Highways: Shen Yu-ming, Peng Ping Chang, Chow Chi, Chen Cheng-Chuan, Clarence Seid.

Heavy Rainfall in Imperial County Closes Main Highways

By E. E. WALLACE, District Engineer

DURING the summer months the desert areas of southern California are subject to very heavy, and rather local rain storms, frequently reaching cloudburst proportions. On August 18, 1945, one of these heavy storms covered practically all of Imperial Valley, but reached its greatest intensity in the southwesterly portion.

On the Kane Springs road in the desert east of Julian, rainfall of five inches was recorded during two major downpours in less than an hour and one-half. Undoubtedly the rainfall was even heavier in other localities.

The combined run-off from the San Felipe and Carriso drainage areas caused flood conditions on San Felipe Creek.

U. S. Highway 80, between San Diego and El Centro was flooded to such a depth that all traffic was stopped west of Seeley.

State Route 111, along the north shore of the Salton Sea was also flooded to such an extent that it was impassable to traffic for 24 hours, consequently all routes from Imperial Valley to the north and west were completely closed. U. S. 80 was opened and restored to traffic on Sunday morning, August 19th, and the North Shore Road was opened to light traffic about noon on Sunday.

The San Felipe Bridge is a timber trestle structure, consisting of 26 spans totaling 496 feet in length. Seven of the spans near the center of the structure were destroyed. Because of the fact that other public utilities were also considerably damaged, it was not possible to secure either material or equipment in Imperial Valley with which to make repairs.

During the war emergency the State had stored for emergency use in the Los Angeles and San Bernardino areas a considerable quantity of bridge timbers and piling, and through the cooperation of maintenance engineers of Districts VII and VIII a sufficient quantity of bridge lumber was immediately routed to the bridge site. A pile driving crew and equipment were secured from the San Diego area, and work on repair of the bridge was started Sunday afternoon. Detour through the flooded river bed was not practicable, so repair crews worked continuously day and night, and the structure was completed and opened to traffic by the following Saturday.





Upper—View of San Felipe Bridge showing washed out section after flood subsided. Lower—View of washout from upstream side showing debris accumulated on pile bents

Maintenance crews from the El Centro, Blythe, and San Diego areas concentrated their efforts on the damaged portions of State highways on the other routes, all of which were cleaned of debris and opened to traffic as promptly as possible.

Many of the protective dikes and levees were destroyed during this storm, and will have to be rebuilt and additional bank protection installed. Considerable credit is due to the maintenance crews for the prompt and efficient handling of this emergency, especially so in view of the limited personnel, and other restrictions imposed by wartime conditions.

Many modern girls dress to kill—and cook the same way.

Channelization on Redwood Highway At Entrance to Hamilton Field

By B. VAN DALSEM, Assistant Highway Engineer

THE reputation of Hamilton Field as a major unit of the Air Transport Command, U. S. Army Air Forces, is well known to dignitaries and military personnel throughout the world. President Truman, Anthony Eden, Commissar Molotov and personages too numerous to mention, as well as thousands of injured servicemen and evacuated prisoners of the Pacific War, have passed through its terminal facilities, reputed to be the largest and most modern in existence.

Approximately 25 miles north of San Francisco, in Marin County, Hamilton Field is located a few hundred yards east of the Redwood Highway (U. S. 101) and access is gained by an entrance road which is flanked by two housing projects, Meadow Park on the north side and Meadow Park Annex on the south.

Except for a truck entrance one-quarter mile north, use of which is prohibited to passenger cars, all traffic entering or leaving Hamilton Field, as well as the two housing projects, must use this road. With the ever increasing activities on the field, this traffic, already heavy throughout the day and night, consisting of official military cars, ambulances and privately owned automobiles of servicemen and civilian employees, likewise increased, resulting in a severely congested traffic condition at the intersection of this road with the heavily traveled highway.

The Redwood Highway, at this intersection, consisted of a three-lane portland cement concrete pavement, 33 feet wide. The Hamilton Field road entered the highway at about the midpoint of a curve having a radius of 1500 feet. Servicemen, hopeful of obtaining transportation to San Francisco and points south, lined up along the west edge of the pavement, causing many kindhearted motorists to stop on the pavement and offer rides.

This pedestrian crossing of the heavily traveled Redwood Highway, occurring directly opposite the intersection and on the curve, created an additional and very dangerous hazard to traffic. Pacific Greyhound Lines maintain a depot on the east side of the highway but southbound buses were forced to make roadside stops to take on and let off passengers, further adding to the general confusion.

On May 7, 1945, Contract 4ATC4 for the construction of a channelized intersection to relieve this serious situation was awarded to A. G. Raisch Company, San Francisco.

The roadbed was graded and widened considerably on both sides of the existing pavement. Two portland

Looking north on U. S. 101 into channelized area at entrance to Hamilton Field





View of traffic channels on Highway U. S. 101 looking east at main entrance to Hamilton Field. Meadow Park Housing Project and Hamilton Field in the background

cement concrete pavement lanes, totaling 23 feet in width, were constructed west of the existing pavement on a long radius curve which permitted a space 27 feet wide between the closest edges of pavement directly opposite the Hamilton Field road, narrowing down to points of contact approximately 400 feet north and south. Appropriate transitions were constructed at each end of these lanes, permitting traffic to leave and return to the original lanes and also provide for future widening outside the limits of this improvement.

A short distance south of the intersection and west of the new pavement lanes, an additional 14-foot portland cement concrete lane with asphalt concrete approaches was constructed. This additional lane permits automobiles and buses to stop and pick up or discharge passengers on an elevated platform without interference to fast moving traffic.

The westerly 10-foot lane of the existing pavement was abandoned and two division islands of varying widths were constructed to serve as a physical barrier to opposing through traffic while also providing an area for accelerating and decelerating lanes as well as a haven of safety where cross traffic may stop before traversing the through traffic lanes. The elimination of this 10-foot lane left 23 feet of the existing pavement for use by northbound traffic.

ENTRANCE REALIGNED

The entrance road to Hamilton Field was realigned for a short distance to permit a right angle intersection with the highway. A division strip curb was constructed, as were two traffic islands to the north and south, to facilitate the distribution of traffic into the proper channels and lanes. Accelerating and decelerating lanes as well as wye connections were constructed of asphalt concrete. Directly north of the intersection another stopping lane and raised platform was constructed on the east side of the highway to handle pedestrian interchange to and from buses and passenger cars.

Asphalt concrete median bars and bituminous roll at both ends of the project and at the opening between the division strip islands add to the channelization pattern.

Asphalt concrete pavement (0.32-foot leveling course plus 0.10-foot type "B" surface) was laid on a six-inch crusher run base. Portland cement concrete pavement (9-inch by 7-inch by 9-inch section) was laid on selected material obtained from roadway excavation within the limits of the project. Eight-foot shoulders were provided throughout to which was applied a penetration treatment of Liquid Asphalt MC-1.

ILLUMINATING SYSTEM

The area of the islands and raised platforms is paved with Type "B" asphalt concrete surface. Light stand-

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Division of Highways Puts New Ferry in Service at Cache Slough

By H. D. STOVER, Bridge Maintenance Engineer

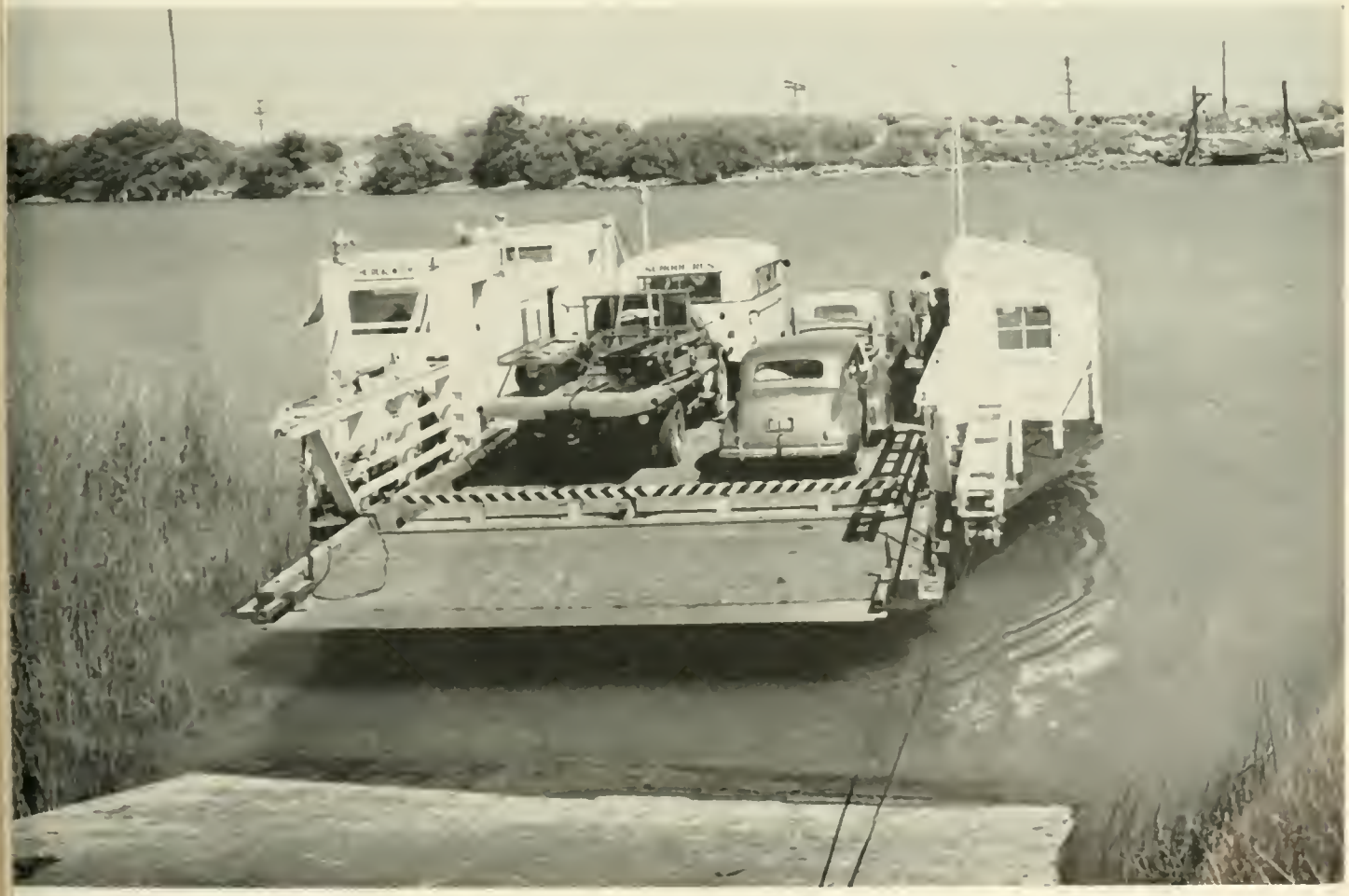
THE old ferry boat at Cache Slough, constructed by the State in 1934, being in constant need of repairs was replaced September 6, 1945, by a new one. This ferry carries traffic down State Highway Route 99-A, from the mainland near Rio Vista, Solano County, to Ryer Island.

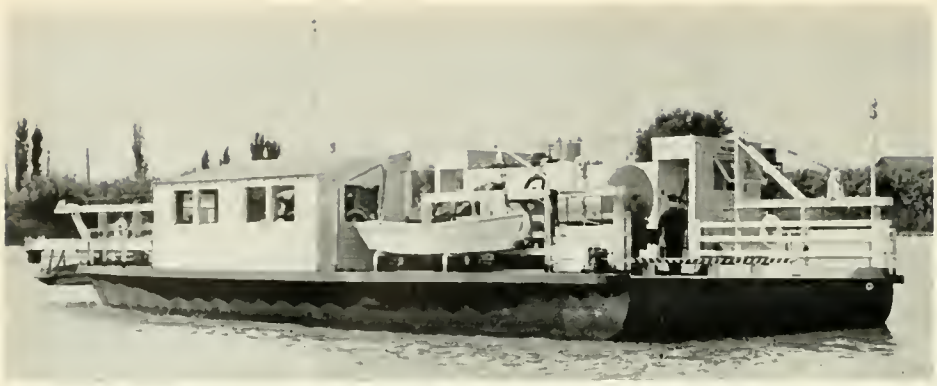
At present there are three ferries operated by the State on the Highway System. These ferries in the past have been of timber construction, but due to wartime restrictions on top grade lumber, it was not practical to construct from timber; therefore, we designed a steel hull for the new Cache Slough Ferry, which construction materials were available under maintenance priorities. This hull was built under contract by Stevens Bros. of Stockton and on completion was towed to a mooring near the Tower Bridge on the Sacramento River. At this location the Division of Highways Equipment Department installed machinery and other necessary features for the proper operation of the ferry. The ferry was christened "The Real McCoy" and towed to Ryer Island.

The new ferry has a substantially longer hull than the old one, having an overall length of 65 feet and a clear roadway width of 21 feet and provides more room for traffic.

One of the outstanding improvements to be found in the new construction was the positive barriers which have been built into the hull to prevent vehicles from over-running the ends of the ferry. Past experiences have indicated the need for more positive barriers at the boat ends, and the device constructed appears to have filled this need in a substantial manner. Normally, the barriers rest level with the floor, but upon operation of a control valve, the barrier is raised vertically by hydraulic pressure to a height of about two feet, providing safety for automobiles or traffic under any normal condition that might be encountered.

This photograph of the new Cache Slough Ferry shows the positive barriers built into the hull to prevent vehicles from over-running the ends of the boat





New ferry of Division of Highways in operation in midstream

Pilot houses have been provided at each end of the boat from which points movement of the ferry is controlled by the operator in either direction. These houses are so constructed to provide the operator with a clear view of the channel at all times, as well as to provide him with complete protection from the elements. The boat has been balanced by separating the machinery into two parts with the use of a transverse cross-shaft. The power supply installed on one side and the cable operating mechanism is placed on the other side of the boat thus eliminating the necessity of ballast on one side to provide even keel as was the case in the former design.

The articulated apron at one end of the boat has been extended and improved to provide better gradient and transition section for traffic entering and leaving the ferry. This is a decided improvement over the facilities previously in use and should reduce the difficulties formerly encountered by traffic going on and off at the landing.

Another decided improvement which makes for more positive operating control is the installation of an air brake working directly against the cable sheaves. This gives the operator an opportunity to retain complete control of his boat from the pilot house during landing operations. The fire control system, consisting of fire house, pumps and accessories which are connected to the boat's power supply, has been provided. An individually operating gas electric system supplying the necessary lighting facilities has been installed.

The Bridge Maintenance Section prepared the plans and specifications for the new carrier and the Bridge Construction Department supervised the inspection of the contract work.

With the various improvements over the old type of design, it is believed this boat will, in fact, be The Real McCoy. There is something in a name.

CALIFORNIA MISSIONS

(Continued from page 20)

those maintained at the other missions hence portions of its history are rather sketchy. In 1824, Fr. Uria reported that the church had been repaired and fortified. In 1826, he recorded the acquisition of a number of church goods. At the end of 1828, Fr. Pedro Cabot noted that tiles and bricks were being made for reconstructing existing buildings. He reported a smithy and carpenter shop in operation. Toward the end of that year, Fr. Prefect Sarria went to Soledad to reside and in December, 1832, recorded that "A provisional church building, sufficiently apt for divine worship, had been erected, because the church which existed before had collapsed in consequence of floods."

INDIANS DISAPPEAR

Only a few Indians remained at Soledad in this year. Alfred Robinson, noted traveler, visited the mission in 1830 and wrote: "It was near sundown when we arrived and dismounted at the door of La Soledad, the gloomiest, bleakest and most abject looking spot in California."

It was in this desolate place that Fr. Sarria, even though in high command of the Franciscan missions, decided to live and die that he might be near his Indian wards. The decree of Governor Figueroa confiscating all missions and dated November 4, 1834, joined Soledad and Mission San Antonio and made them a curacy of the second class. Fr. Sarria, ill nourished and worn out, died at Soledad on Sunday, May 24 1835. He was buried at Mission San Antonio.

In August of that year, civil commissioners took an inventory at Soledad and placed a value of $47,297.12 upon the mission and property. In 1841, Mofras visited the mission and wrote "Now not one Indian, nor one head of livestock is encountered. All has gone to ruin. The vineyards are abandoned, the gardens uncultivated, and the fruit trees in the orchards grow wild for want of pruning."

RUINS OF SOLEDAD

In June, 1846, Governor Pio Pico sold Soledad to Feliciano Soberanes for $800. Bancroft, the historian, says that a year before an inventory valued the mission and property at $2,494.

President James Buchanan returned Mission Soledad to the Catholic church in November, 1859.

In 1904, George Wharton James, on his tour of the California missions, wrote of Soledad:

"Over the entrance of the church—the ruins of which now bring sadness to the hearts of all who care—is a niche in which a statue of Our Lady of Solitude — La Soledad — used to stand. Methinks that if the ghost of things that were exist, surely a weeping ghost of the Lady of Solitude haunts these deserted and forlorn ruins. Weep, weep on! for the church of Our Lady of Solitude. It is entirely in ruins."

And some such sentiment must stir in the hearts of all who visit the ruins of La Soledad today.

* * *

The ruins of La Soledad are easily reached by the visitor to the California missions. They are located just south of Soledad in Monterey county on the Coast Highway, U. S. 101. Southern Pacific trains stop at Soledad. Motorists coming either from the north or south will use the Coast Highway.

From San Joaquin Valley points the route is from Hanford west through Lemoore and Coalinga to San Lucas over the Sierra to the Sea Highway, thence north on U. S. 101 through King City and Greenfield to Soledad. The mission visitor should take a side trip from Soledad to the famous Pinnacles National Monument, one of the most attractive scenic spots in the State.

Next—Mission San Juan Bautista and Mission San Carlos Borromeo.

Tragic End of Lt. Greenwood Is Confirmed

DISTRICT Highway Engineer Paul O. Harding, Stockton, has reported to the Division of Highways an official report of the death while a prisoner of war of the Japanese of Lt. George H. Greenwood, a former employee of the division.

Navy Department confirmation of Lt. Greenwood's death was forwarded to Harding by Captain Esther Greenwood, U. S. Marines, the widow, now stationed in Washington, D.C.

Lt. Greenwood left State service officially on June 4, 1941. He had, however, prior to this date, sailed from San Francisco under date of May 8, 1941, for Cavite to his assignment with the United States Navy as a Lieutenant, Junior Grade. He had before being captured, been promoted to the grade of Lieutenant, Senior Grade.

Lt. Greenwood, with the United States Army and military personnel, was captured on Corregidor on May 6, 1942. From information gathered, he was taken from Corregidor to Cabanatuan October, 1942. He was moved from Cabanatuan to Davao, Mindanao. In June, 1944, he was moved from Davao to Cabanatuan; in October, 1944, from Cabanatuan to Bilibid.

On December 13, 1944, he was loaded on to a prison ship for conveyance to the Japanese homeland. On December 15, en route, this ship was torpedoed by the United States Navy. Several lives were lost, others were able to make it to the land in the vicinity of Lingayan, at that time in enemy possession. These men were again loaded on a ship which set out for the homeland and this ship was also torpedoed by the United States forces.

Approximately 1,700 American personnel had been loaded on the first ship at Manila and the United States Government has received a list of names of those that had survived, amounting to some 400. Greenwood's name does not appear among the survivors.

The Chief of the Navy Personnel has informed Mrs. Greenwood that it is now known that Lt. Greenwood lost his life while in the service of his country.

Resumption of Snow Removal Is Announced

SNOW removal operations on mountain roads serving industrial and recreational traffic, abandoned during the war at the request of military authorities on all but essential routes, will be resumed by the Division of Highways this fall and winter, Governor Earl Warren has announced.

New snow removal equipment will shortly be available for use on Echo Summit, U. S. 50, replacing that which it was necessary to transfer to Donner Summit during the war emergency, the Governor said.

Clearing of snow from mountain highways during the winters since Pearl Harbor was greatly restricted not only because the Army and Navy desired important transcontinental routes such as U. S. 40 over Donner Summit be kept open for military reasons but also because deteriorated equipment which could not be replaced had to be conserved.

The Governor said that Director of Public Works C. H. Purcell had reported to him that a majority of the snow removal work can be handled by the present personnel of the Division of Highways and that it is desirable to resume snow clearance on these highways to the same extent to which it was performed prior to the war.

Among the routes on which snow removal services will be resumed, as announced by the Governor, are:

Kyburz to the Nevada State Line over Echo Summit, on State Route 11.

Meeks Bay to Tahoe City on Route 38.

Sierra City to Bassetts, on State Route 25.

Arnolds to Camp Connell, on State Route 24.

Long Barn to Pinecrest, on State Route 13.

Tahoe City to the Nevada State Line, on State Route 39.

Coarsegold to the Yosemite National Park boundary, on State Route 125.

Pinehurst to the General Grant Park boundary, on State Route 41.

Igo to South Fork, on State Route 190.

Bridgeport to the Nevada State Line, on State Route 96.

Morgan Summit Junction, State Sign Route 36, to southerly boundary of Lassen National Park.

Shingletown to Lassen National Park, on State Route 20.

Descanso to Santa Ysabel, on State Route 78.

Sgt. Jantzen Wins Citation For Bravery

WHEN Sgt. Herman R. Jantzen, on military leave from District X, Division of Highways, Stockton, returns from the war to resume his State position, he will bring with him a fine commendation from his Commanding Officer, Lt. Col. Ewel J. Morris, Jr., 1st Field Artillery Observation Battalion, U. S. Army.

Sgt. Jantzen, prior to entering the military service, was an engineering employee in District X, with a civil service classification of Assistant Highway Engineer. He had been employed in District X since June 1, 1938. His assignments consisted of location surveys, planning and designing in the District Office and assistant construction engineer on construction.

Previous to his employment in District X, he was employed in District XI as a Senior Engineering Aid and with the State Compensation Insurance Fund as a Junior Safety Engineering Inspector. Sgt. Jantzen left the State service for his military assignment on March 12, 1943. He is 39 years of age and single.

The citation awarded Sgt. Jantzen reads as follows:

"You are commended for outstanding performance of duty to your country as Surveyor and Geodetic Computer with this organization. During your 28 months of service, 24 months overseas, and 19 months in combat, your duties have been performed with unselfish loyalty and devotion.

"You have willingly undergone the hardships of battle under the worst conditions of snow, ice, mud, rain, and intense heat, against a determined, efficient, and resourceful enemy. The bravery and skill with which you have fought him has brought him complete defeat.

"The contribution to the cause of freedom and security which you have made in the Sicilian, Naples-Foggia, Rome-Arno, Southern France, Rhineland, and Continental European Campaigns deserves the highest commendation."

Recent Highway Repair in Yuba, Sutter Counties

By F. D. HILLEBRAND, Assistant Highway Engineer

RECENTLY completed repair construction at three locations in Yuba and Sutter counties has done much to provide a smoother and greatly reinforced pavement which during the war period had received much damage from increased heavy trucking and military traffic.

To motorists and truckers one of the worst stretches of State highway in Central California was perhaps in Yuba County on U. S. 99E between Morrison Crossing and Linda Corners, directly south of Marysville. Considerable roughness coupled with a crown as high as 9 inches, no superelevation at curves, and steep shoulders dropping abruptly from the pavement edge gave this section of road an unfavorable reputation with the traveling public.

Before the war emergency, this macadam surfacing had proved structurally adequate although considerable maintenance was necessary each year. Soon after the Nation entered the war, heavy trucking by contractors engaged in the construction of Camp Beale and the Marysville Army Airfield, and the military access roads to these areas, caused considerable deterioration to the surfacing on this highway. This heavy duty service, coupled with large convoys of all types of Army vehicles, including heavy tanks, using this roadway made resurfacing imperative this year.

HIGH CROWN ELIMINATED

The improvement just completed consisted of placing plant-mixed surfacing 20 feet wide and to an average thickness of 3 inches over the existing pavement, and constructing gravel shoulders four feet wide with variable slopes. The total length of the project was 7.34 miles.

To eliminate the excessive crown the surfacing was restricted to a minimum depth at the centerline of 1½ inches with an increasing average depth at the pavement edge amounting to 4½ inches.



Upper—Showing patched surfacing with low edges and shoulders. Center—Showing curve with no superelevation of old pavement. Lower—General view of old pavement, rough riding characteristics not being apparent in view

To provide some superelevation where none before existed on curves it was necessary at some locations to increase the thickness of the surfacing to 12 inches at the edges. For correction of the uneven and rough riding qualities of the existing pavement the new surfacing was placed in two courses. Where it was necessary to use additional material for building superelevations at curves the surfacing was placed in additional courses in order to obtain sufficient compaction.

The first course of the ½-inch maximum surfacing material was spread with a heavy, long wheel base motor grader equipped with mould board wings. By maintaining the grader blade at a constant height and carrying a full blade of material it was possible to float out most of the surface irregularities. Each course after being spread was thoroughly compacted with an 8-ton tandem roller and then allowed to cure under the action of traffic for at least 24 hours before the next course was placed.

TRAFFIC UNINTERRUPTED

A mechanical spreading and finishing machine was used for the last or surface course and brought the finished pavement to the required cross-section. Traffic at all times was permitted to pass through the work. During construction, activities were confined to one-half width of roadway and traffic regulated by flagmen and a pilot car.

The elimination of most of the excess crown and the addition of superelevation at curves has resulted in greatly improved riding qualities on this section.

Borders were not constructed until paving operations were finished. Prior construction of borders was not feasible as the thickness of the new surfacing was not uniform and a varying amount of imported borrow was required to bring the finished border to the grade of the new pavement.

Clean creek gravel with which a uniform amount of binder material was incorporated was used as border material. This imported borrow was placed in several courses by means of a spreader box and the material was watered and thoroughly compacted by rollers.

WORK ON TWO SECTIONS

The repair work in Sutter County was performed on two sections of highway. On U. S. 99E between the north city limits of Yuba City and Lomo, six areas aggregating a total length of 2.39 miles were repaired by placing over the old, badly broken concrete pavement, a blanket of plant-mixed

(Continued on next page)



Upper—Location same, showing new surfacing and completed borders. Center—Location same, showing superelevation in new surfacing. Lower—General view, same location, showing completed roadway

Highway Bids and Contract Awards

August 1945

COLUSA COUNTY—Between Williams and 2.8 miles easterly, about 2.8 miles to be repaired with plant-mixed surfacing. District III, Route 15, Section Wms. A. E. B. Bishop, Orland, $18,280; Lester L. Rice, Marysville, $20,495. Contract awarded to Harms Bros., Sacramento, $17,704.

KERN COUNTY—Between Lost Hills and Wasco, about 4.7 miles to be repaired with imported borrow base and road-mixed surfacing. District VI, Route 33, Section C. Chas. C. Heuser & R. A. Garnett, Glendale, $68,309; Charles J. Dorfman, Los Angeles, $69,242; Clements & Co., Hayward, $69,920; Basich Brothers Construction Co., Alhambra, $75,762; Volpa Brothers, Fresno, $78,052; Norman I. Fadel, North Hollywood, $78,061; Louis Biasotti & Son, Stockton, $83,446; Guerin Bros., Los Angeles, $88,007; M. J. Ruddy & Son, Modesto, $89,858. Contract awarded to Oilfields Trucking Co., Bakersfield, $66,408.

KERN COUNTY—Between Route 23 and 8 miles east of Inyokern, about 12.2 miles to be repaired by placing plant-mixed surfacing and applying seal coat thereto. District IX. Oswald Bros., Los Angeles, $84,900; Basich Brothers Construction Co., Alhambra, $86,741; The Tanner Construction Company, Phoenix, Arizona, $98,540; Southwest Paving Company, Roscoe, $104,587; J. E. Haddock, Ltd., Pasadena, $107,000; Oilfields Trucking Company, Bakersfield, $107,241; Charles J. Dorfman, Los Angeles, $112,985. Contract awarded to Lewis Construction Co., Los Angeles, $70,160.

LOS ANGELES COUNTY—In the City of Burbank, between Orange Grove Avenue and San Fernando Boulevard, about 0.6 mile, to be graded and surfaced with asphalt concrete on the existing surfacing and new crusher run base. District VII, Route 4, Griffith Co., Los Angeles, $36,992; Chas. T. Brown Co., San Fernando, $39,096; Oswald Bros., Los Angeles, $41,638; Schroeder & Co., Roscoe, $44,812. Contract awarded to Chas. J. Dorfman, Los Angeles, $34,369.

MENDOCINO COUNTY—At Blue Slide Gulch, about 13.1 miles north of Fort Bragg, a concrete bridge to be constructed about 0.19 mile to be graded, surfaced with imported base material and a seal coat applied. District I, Route 56, Section F. Fred J. Maurer & Son, Eureka, $69,996; Guerin Bros., South San Francisco, $74,559; Fredrickson & Watson Construction Co., Oakland, $83,457. Contract awarded to John Burman & Sons, Eureka, $66,699.

SAN DIEGO COUNTY—About 18 miles north of Oceanside, a reinforced concrete girder bridge to be constructed across San Mateo Creek. District XI, Route 2, Section D. J. E. Haddock, Ltd., Pasadena, $148,783; Matich Bros., Colton, $149,438; Guerin Bros., Los Angeles, $172,554; Carlo Bongiovanni, Hollywood, $176,796; Baruch Corp., Los Angeles, $191,920; Byerts & Dunn, Los Angeles, $192,216; The Contracting Engineers Co., Los Angeles, $193,618; Ralph A. Bell, Monrovia, $196,845; Guy F. Atkinson Co., Long Beach, $197,735; Fred D. Kyle, Pasadena, $205,224; M. H. Golden Construction Co., San Diego, $219,492; Dimmitt & Taylor, Los Angeles, $250,708. Contract awarded to Oberg Bros., Inglewood, $146,867.

SOLANO COUNTY—On Tennessee and Georgia Streets, between Vallejo and Route 7, about 0.9 mile to be resurfaced with asphalt concrete pavement on cement treated base. District X, Vallejo Bus Routes. C. M. Syar, Vallejo, $16,679. Contract awarded to Sheldon Oil Company, Suisun, $10,674.

TUOLUMNE COUNTY — Across Tuolumne River about 10 miles west of Groveland, repairing a bridge. District X, Route 40, Section B. Stockton Construction Co., Stockton, $3,435; C. C. Gildersleeve, Willows, $3,631. Contract awarded to James H. McFarland, San Francisco, $2,413.

YUBA COUNTY — Between Wheatland and Morrison Crossing, about 2.4 miles to be repaired with plant-mixed surfacing. District III, Route 3, Section A. Contract awarded to Lester L. Rice, Marysville, $12,175.

September 1945

ALAMEDA AND CONTRA COSTA COUNTIES—Between El Cerrito Hill Overhead and Route 14, about 1.4 miles to be resurfaced with asphalt concrete pavement. District IV, Route 69, Section Alb.,Rch.,E.Cr., Independent Construction Co., Ltd., Oakland, $36,792; Chas. L. Harney, San Francisco, $39,118; Lee J. Immel, Berkeley, $39,243. Contract awarded to Louis Biasotti & Son, Stockton, $36,589.

HUMBOLDT COUNTY — At Shively Bluffs, about 9 miles south of Scotia, a distance of about 0.2 mile, four permeable pile jetties to be constructed. District I, Route 1, Section D. Healy Tibbitts Construction Co., San Francisco, $56,975; Fred J. Maurer & Son, Eureka, $59,970; E. B. Bishop, Orland, $64,072; Case Construction Co., Alameda, $66,016. Contract awarded to Mercer, Fraser Company, Eureka, $40,751.

INYO COUNTY—Between Beatty Road and east boundary Death Valley National Monument, about 0.75 mile to be repaired with road-mixed surfacing on imported borrow. District IX, Route 127, Section K. Basich Brothers Construction Co., Alhambra, $13,813; Spencer Webb, Los Angeles, $13,897; Arthur A. Johnson, Laguna Beach, $18,263; Oilfields Trucking Co., Bakersfield, $18,917. Contract awarded to Vinnell Co., Alhambra, $12,761.

MENDOCINO COUNTY—At Alder Creek, about 7 miles north of Point Arena, about 1.2 miles to be graded, surfaced with gravel base, a seal coat applied to gravel base and a steel plate girder bridge to be constructed. District I, Route 56, Section B. Fredrickson Bros., Emeryville, $186,666; Fred J. Maurer & Son, Eureka, $204,130; Guy F. Atkinson Company, South San Francisco, $215,671; Fredrickson & Watson Construction Co., Oakland, $218,837; Dan Caputo & Edward Keeble, San Jose, $223,933; E. B. Bishop, Orland, $224,472; Louis Biasotti & Son, Stockton, $235,006; N. M. Ball Sons, Berkeley, $246,472. Contract awarded to Guerin Bros., South San Francisco, $182,963.

ORANGE COUNTY — About 2½ miles southerly of Tustin, two reinforced concrete box culverts to be constructed. District VII, Route 2, Section C. Paul E. Woof, Bakersfield, $18,847; Oberg & Cook, Los Angeles, $19,390; F. Fredenburg, Temple City, $21,997; Oberg Bros., Inglewood, $23,127; Tomei Construction Co., Van Nuys, $26,020; The Contracting Engineers Co., Los Angeles, $29,585. Contract awarded to Wm. E. Thomas Construction Co., Hayward, $16,757.

ORANGE AND SAN DIEGO COUNTIES —Between one mile north of Las Flores Creek and San Clemente, about 9.5 miles, existing highway to be widened and paved with portland cement concrete and portions of existing pavement to be resurfaced with asphalt concrete. District XI, Route 2, Section D,8Cle. Matich Bros., Colton, $696,579; Basich Bros. Construction Co. & Basich Bros., Alhambra, $709,282; Griffith Co., Los Angeles, $722,453; Peter Kiewit Sons' Co., Los Angeles, $786,586; The Tanner Construction Co., Phoenix, $791,634; Oswald Bros., Los Angeles, $827,281; Ralph A. Bell, Monrovia, $836,489; Macco Construction Co., Clearwater, $889,810; J. E. Haddock, Ltd., Pasadena, $898,543. Contract awarded to N. M. Ball Sons, Los Angeles, $637,799.

SAN JOAQUIN COUNTY—Across Mokelumne River about one mile north of Clements, a bridge to be repaired. District X, Route 97, Section B. J. R. Reeves, Sacramento, $3,995; M. A. Jenkins, Sacramento, $4,580; Geo. Pollock Co., Sacramento, $4,695. Contract awarded to Lord & Bishop, Sacramento, $3,650.

SHASTA COUNTY—Between 1.6 miles west of Round Mountain and 0.3 mile west of Montgomery Creek, about 2.8 miles to be repaired with crusher run base and seal coat. District II, Route 28, Section B. E. B. Bishop, Orland, $64,880; J. Henry Harris, Berkeley, $66,069; A. R. McEwen, Sacramento, $66,210; Clements & Co., Hayward, $75,930. Contract awarded to Harms Bros., Sacramento, $46,622.

SISKIYOU COUNTY — Between Gazelle and Klamath River, about 1.9 miles to be repaired with gravel base and crusher run base and a seal coat applied thereto. District II, Route 3, Sections B,C. E. B. Bishop, Orland, $33,370; J. Henry Harris, Berkeley, $41,143. Contract awarded to Clements & Co., Hayward, $30,968.

Yuba and Sutter Counties Recent Highway Repair

(Continued from preceding page)

surfacing 21 feet wide and 2 inches thick. Two foot transverse tapers were constructed on each side of the central 21 feet decreasing in thickness from 2 inches to ½ inch. The surfacing was spread on the roadbed in two courses consisting of a leveling course and a surface course.

From Sutter Bypass north to Tudor Road on the highway between Yuba City and Knights Landing a similar section of repair work was done in Sutter County. The existing surface was constructed by Sutter County in 1930 and consisted of a 20-foot by 6-inch asphalt concrete pavement. Under heavy trucking of farm products this surfacing had deteriorated to a degree that made blanket resurfacing necessary.

The major items of this work were:

11,900	cubic yards Imported Borrow (gravel)
22,000	tons Plant-mixed Surfacing
800	M. gallons Water
34	tons Asphaltic Emulsion

The total cost of the work was approximately $105,000.

This reconstruction at the three locations was let under one contract to Lester L. Rice of Marysville. F. D. Hillebrand was the resident engineer for the State.



Governor Warren and Members of the State Park Commission pause while touring the Redwood Empire. Left to right: Isadore Dockweiler, Los Angeles; Joseph R. Knowland, chairman of Commission; the Governor, and Charles Kasch, Ukiah

Governor Earl Warren Wants Redwoods Preserved for Posterity

(Continued from page 2)

resided. Before returning to Eureka nn the party made a tour of Fort Dick nd Mill Creek via the Pebble Beach Drive, viewing the Peacock Hill highway alignment.

The Humboldt County Board of Trade was in charge of arrangements or the Governor's banquet in Eureka. Elmer P. McKenzie of the Redwood Empire Association acted as master f ceremonies. Fred Anderson, chairman of the board of supervisors, welomed the Governor and the other visitors on behalf of the county and Mayor ohn Ryan of Eureka performed a milar service for the city.

In addition to Governor Warren and Ir. Purcell, Senator Irwin Quinn, H. . Rick, Chairman of the State Fish nd Game Commission, Mr. Knowland, nd Charles Kasch of the Park Commission, George C. Hoberg, President f the Redwood Empire Association, and Richard Fleischer made brief talks.

Accompanying Mr. Purcell on the tour were the following members of the Highway Commission:

Homer P. Brown, Placerville; Chester H. Warlow, Fresno; Harrison R. Baker, Pasadena; James A. Guthrie, San Bernardino; Walter Sandelin, Ukiah, and C. Arnholt Smith, San Diego, and George N. Cook, secretary.

State Highway Engineer McCoy was accompanied by Colonel John H. Skeggs, District Highway Engineer at San Francisco, and District Highway Engineer A. M. Nash of Eureka.

With Chairman Knowland were Park Commissioners Isadore Dockweiler, Los Angeles, and Charles Kasch, Ukiah; A. E. Henning of Sacramento, Chief of the Division of Parks, and John H. Covington, Executive Secretary of the Commission. General Warren Hannum, Director of Natural Resources, and Colonel E. C. Kelton, Beach Erosion Engineer of the Park Commission, were members of Mr. Knowland's party.

The Golden Gate Bridge and Highway District was represented by Edward A. Kenney, San Francisco, and James E. Rickets, General Manager.

Arrangements for the tour were made by Mr. Hoberg, President, Valerie Kuhn, Manager, and Marsh Maslin, Publicity Director, of the Redwood Empire Association.

Two married men were discussing their joys and sorrows.

"My wife," said one, "is very poetic. She gets up at sunrise, wakens me and says 'Lo, the morn'".

"Huh," replied the other, "My wife wakens me and says 'Mow the lawn.'"

Highway Channelization at Entrance to Hamilton Field

(Continued from page 24)

ards were constructed and State forces will soon install an illumination system. Existing pipe culverts, long proven to be inadequate, were replaced with reinforced concrete pipe culverts and new drop inlets were installed to complete the drainage facilities.

Two huge meters, through which over a million gallons of water flow into Hamilton Field each day, were necessarily moved during construction operations. This work was done by forces and equipment of the Marin Municipal Water District under service agreement. Right-of-way acquisition required the moving of a service station and its adjoining buildings.

The final cost of the project is approximately $55,000 financed from Federal Access Road Funds. Work on Contract 4ATC4 began on May 15, 1945 and was completed September 6, 1945. William Russel was superintendent for A. G. Raisch Company. W. A. Rice was Resident Engineer for the Division of Highways.

HIGHWAYS OF CALIFORNIA

(Continued from page 9)

divided sections on the State highway system. On top of the mesa the old route was almost a tangent from its junction with the new Rose Canyon section to that of the new grade leading down to the ocean at Sorrento Creek. This portion of the old road was flanked on either side by a row of trees, an asset of considerable value to the appearance of the route. Widening the old 16-foot pavement to a desired minimum of 30 feet would have necessitated removal of one row of the trees. To avoid doing this, the old pavement was widened to 20 feet and a new two-lane strip placed parallel and outside the easterly row of trees. By using the old road for southbound traffic and the east for travel to the north an adequate and attractive divided highway was provided.

As a State highway, the Torrey Pines grade has passed into road history. El Camino Real still carries the traffic, but the brown-robed Franciscans, ox carts and wealthy owners of haciendas have given way to fast moving streams of cosmopolitan traffic in high-powered cars and dual-wheeled trucks. Progress in travel is evidenced in speed, ease, and comfort, while the charm of early California living slips away to appear only in printed books.

To be continued

In Memoriam

George Hamilton Greenwood

DISTRICT X of the State Division of Highways regrets to report the death of Lieutenant George H. Greenwood, U.S.N.R., while in the service of his country at the age of 37 years, 2 months and 13 days. The Federal Government has set the date of death at December 15, 1944.

Lt. Greenwood was a very valuable and efficient employee of the Division of Highways, having worked continuously in an engineering capacity since his employment, May 15, 1929, to the date of his leave of absence, June 4, 1941, to join the Naval forces. During his period of employment with the State, he worked at various engineering assignments from a position of Draftsman in the District Office and on location surveys, to Surveyor, Construction Assistant, and at the time of leaving the State service, was the District Traffic and Safety Engineer.

Lt. Greenwood's early schooling, grammar and high school, was in and about the Bay region, particularly in San Francisco. He graduated from the University of California with a B.S. degree in engineering in 1929 with high honors. He was a member of three engineering honor societies, Chi Epsilon, Tau Beta Pi and Sigma XI, and a member of the American Society of Civil Engineers. He was born on October 2, 1907, in San Francisco. He is survived by his wife, Captain Esther Trefts Greenwood, now assigned to the Women's Corps of United States Marines, with duties in Washington, D. C., his mother and father, Mr. and Mrs. Joseph Theodore Greenwood of San Francisco.

Many Miles of Our Highways Still in Mud, Says Engineer

AMERICA'S highways and byways are still far from "out of the mud" according to Charles M. Upham, engineer-director of the American Road Builders' Association.

"The public usually thinks of highways in terms of concrete, four-lane, limited access freeways and forgets the many thousands of miles of roads and streets that are unsurfaced. We have a big job ahead making these 'underprivileged' roads passable the year round," he said.

Insisting that mud and dust are still important highway problems especially in the rural areas, Mr. Upham announced that while 83 per cent of the 563,520 miles of state-controlled highways were surfaced, only 73 per cent of the 304,000 miles of municipal streets and alleys and 49 per cent of the 1,928,000 miles of county and local roads have all-weather treatment. By surfacing is meant construction of concrete, asphalt and tar coating, gravel or stabilized earth.

"The figures I quote are from 1940, the year before America entered the war and the last year of general construction. Since then road building has been at a standstill except for access roads to munition plants and military establishments," Mr. Upham said.

Studies by the Public Roads Administration of the various types of surfaces show that the average life of soil roads is from five to 14 years; gravel or stone six to 13 years; bituminous surface treated 11 to 21 years; mixed bituminous 14 to 22 years; bituminous concrete 13 to 20 years; portland cement concrete 17 to 24 years and brick or block 19 to 21 years. Naturally such factors as the kind and volume of traffic, action of the weather, types of materials used, design, quality of construction and others enter into the deterioration and retirement of a highway.

"These points must receive careful consideration by highway officials in preparing a postwar building program. With our roads in the worn condition that they are, and the proposed changes in motor vehicles promised soon, not only surfacing, but the proper surface and design to use becomes vitally important," Mr. Upham said.

State of California

EARL WARREN, Governor

Department of Public Works

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CALIFORNIA STATE HIGHWAY SYSTEM ITS NEEDS, PROBLEMS, AND OUTLOOK

By C. H. PURCELL, Director of Public Works and Chairman California Highway Commission

The following address was delivered by C. H. Purcell, Director of Public Works and Chairman of the California Highway Commission, at the annual meeting of the California State Chamber of Commerce in Los Angeles on November 29th.

THE needs and problems of the California State Highway System and the outlook for its development are subjects of more than considerable magnitude. They are of such size that any discussion of the details would be most impractical in a brief address. It is my purpose today, to ask you merely to stand off with me at a little distance and look at the system and the problems of its administration with some degree of perspective—to appraise the subject of highway transportation and the relation of State roads to that subject as a whole.

Transportation is a fundamental thing. It is so basic to the whole scheme of living that the progress of civilization may be measured by it. Of all transportation media, road transport has always been and continues to be the primary means of movement and intercommunication. Development of the motor vehicle and its mass production have made it a universal means for locomotion. The wartime restrictions placed upon motor travel demonstrated, with results near to catastrophe, that the economy of this Nation is completely dependent upon this universal method of transportation and that any drastic curtailment of it would mean certain breakdown of that economy.

Further, it seems self-evident that expansion of motor transportation to the maximum extent of its usefulness is dependent upon the expansion of physical facilities which it requires for unfettered movement.

GOOD HIGHWAYS VITAL

Whatever is of importance to highway transport in general, applies with added force to California. To an unusual degree, California is indebted to roads for her already phenomenal development. Her highways made possible the development—the development did not bring the highways. This state with its great distances, its extremes in topography, climate and resources could not have evolved into the great commonwealth of today without its road systems.

In California the term "road transport facilities" is nearly synonymous with "State highway facilities" since, although the mileage of the State Highway System comprises but one-eighth of all rural roads in the State it carries three-fourths of highway travel outside of cities.

During the year 1941, prior to wartime restrictions on transportation, traffic on the 14,000 miles of the State Highway System totaled nearly 13,000,000,000 vehicle-miles. This was nearly one-half of *all* motor travel for that year in California, both inside and out of cities.

TRAFFIC INCREASES

Traffic counts taken on the State Highway System during October, 1945, show an increase of 51 per cent over October a year ago and, what is more significant, the 1945 count shows an increase of approximately 10 per cent over the October, 1941, count. This latter comparison for a period only one month after the end of gasoline rationing, is a pointed indication of the difference which may be expected between prewar and postwar traffic.

Analyses of current traffic data for the State Highway System show that 22 per cent of the vehicles traveling up and down and across California are freight vehicles. During the 10 years immediately prior to the war, passenger car registration in this State increased by 41 per cent but in the same time the number of trucks gained 122 per cent and trailers went up 279 per cent. There is little doubt but that during postwar years the ratio of freight to passenger vehicles will continue to increase, although probably not at the high rate of the 10 years prior to the war.

What of the State highway facilities which are available for this increasing traffic?

SYSTEM DEFICIENT BEFORE WAR

Before the war the State Highway System was deficient to the point where the Division of Highways in its report of 1941 on "Highway Needs" estimated that a sum of $450,000,000 would be required to bring the system to satisfactory standards of the period.

This estimate was based upon construction activities of the Highway Department before National and State recognition of the broad responsibility of the higher levels of government for highway transport within cities and for freeway construction in congested urban areas. Proper consideration of this factor, together with the deterioration resulting from the cessation of construction and reconstruction under wartime restrictions which limited State highway activity to maintenance and repair has increased this estimate for correction of critical deficiencies to $695,000,000.

CRITICAL DEFICIENCIES

These critical deficiencies fall into five general categories.

1. Critical bridges.

2. Structural weakness of road base or pavement.

3. Inadequate traffic capacity.

4. Specific points of hazard or obstruction.

5. Required freeways.

There are many things which may act to restrict or to prevent the use of a highway, but none is more obvious or positive in effect than an inadequate bridge. There are many such bridges on the State Highway System and they are distributed throughout the State. The Division of Highways considers a bridge critical when, because of weakness or deterioration its replacement will be required within an eight or 10-year period. Roughly such structures fall into three classifications:

POSTED BRIDGES

First, are those posted bridges which are both too weak in original design to carry legal loads and at the same time are now in poor physical condition. These are of primary concern.

Second, are bridges which at present are sufficiently strong to carry legal loads, but in which deterioration has progressed to such degree that the structure must either be posted or replaced in the near future.

The third class is made of those bridges which, while in fair physical condition at the present time are so weak or restricted in design that replacement will be required within a few years.

WEAK ROADBEDS

Roadbeds which are structurally inadequate for the type of traffic they are called upon to carry are doubly critical. Such weakness tends to restrict or altogether preclude travel at normal speed and of legal load. When this occurs the highway has failed in its fundamental purpose and, at the same time, in the endeavor to keep traffic restrictions to a minimum excessive maintenance expenditures can not be avoided.

Like critical bridges, sections of critically weak roadbed or pavement with their attendant high maintenance costs are to be found throughout the system.

Traffic on the State Highway System is now more than that system can carry and as previously stated there are still further increases to come. It is fully realized by the California Highway Commission, the Division of Highways and myself that we have not kept pace with traffic increase and have been steadily falling behind in the matter of providing the additional lanes which the increased volume requires. This is a matter of grave concern to State highway officials for, if the State's development is to go forward unhindered, transportation facilities must be provided *in advance* to accommodate the increasing traffic which the very existence of adequate roads helps to create.

HIGHWAY CAPACITY

In estimating capacity-deficiencies of the system, the need of additional lanes included those present two- and three-lane highways which carry a minimum of 5,000 cars per day or frequent peaks of 600 or more per hour. As would be expected, such sections of the State Highway System are closely related to the more heavily populated areas.

At points where traffic analysis shows an abnormal rate of accident recurrence, or where obstructions such as slides, flood damage, or roadway subsidence, continue at such frequent intervals as to seriously delay or hinder traffic, elimination of the deficiencies are planned through correction in the roadway design and structure.

The urban traffic problem, particularly in the larger centers of population, presents a combination of critical deficiencies that result from inadequate traffic capacity, traffic hazards, and specific obstructions in such quantity and with such frequency that to deal with the immense volume of motor traffic in these areas requires more than simple correction of the physical highway facilities. In such locations, an integrated system of freeways designed to serve the entire area is basic in the solution of the transportation problem.

$695,000,000 REQUIRED

It is for the correction of these critical deficiencies that the $695,000,000 will be required.

With the exception of the addition in 1937 of the 3-cent tax on diesel oil used as motor vehicle fuel, the base of State revenue for road purposes has remained unchanged for nearly 20 years. With exhaustion of funds from the three State highway bond issues, the original two-cent gas tax was passed in 1923, one cent being given to the counties and one cent to the State Highway Department for reconstruction of highways built under the bond



C. H. PURCELL

acts. In 1927 a third cent was added to the gas tax for the purpose of providing funds for new construction on the State Highway System.

At this time the State Highway System was just about one-half its present extent: 6,565 miles in 1928. By 1932 the system had been increased to 7,347 miles and the revenue from the State's two-cent share of the gas tax was providing $2,370 per mile.

MILEAGE ADDED IN 1933

In 1933 the State Legislature added 6,600 miles to the system, nearly doubling the mileage. There was then available only $1,260 per mile from the gas tax revenue. In the same year the Legislature earmarked the net revenue from one-fourth cent of the gas tax for use on State routes through cities, this again reduced the amount available per mile on the rest of the system to $1,020. In 1935 a second one-fourth cent was given to the cities for improvement to streets of major importance other than State routes, this resulted in a further reduction to the point where the revenue from the gas tax provided only $910 per mile of State highway. Thus, in a short period of three years, the amount of State revenue available from the gasoline tax dropped from $2,370 to $910 per mile of State highway—a reduction of almost 62 per cent.

MOTOR VEHICLE REGISTRATION

During this period motor vehicle registration in California increased from 2,080,000 in 1932 to 2,657,000 in 1937, a rise of approximately 28 per cent. But the increase in number of vehicles was only part of the change for it was during these years that changes in design and speed of cars, in size and load of trucks and trailers were most drastic. These changes in volume and types of traffic demanded corresponding changes in highway design and construction standards.

During the twenties, advances in automotive design necessitated the discarding of eight-foot lanes and four-inch pavements in favor of ten-foot lanes and pavement thickness was increased to six inches. In turn, as traffic density, speed, and the number of truck loads increased, the old standard lane of 10 feet was widened to 11 feet for two-lane pavements and a combination of 12 and 11 feet for multiple-lane routes. Similar changes to seven and nine inches were made in pavement thickness in order to accommodate the heavier trucking loads. Standards now proposed by the Federal government for major highways to be included in the Interregional Highway System provide for a minimum lane width of 12 feet.

FREIGHT LOADS

While most of you undoubtedly have been aware in a general way of the increase in the size of freight loads traveling the highways, it is wondered how close your estimates are to the facts. Between 1936 and 1944 average weights of empty trucks and trailer combinations increased 34.7 per cent; the average of loaded trucks and combinations rose from 14,000 pounds to 23,500 pounds, an increase of 70.3 per cent; and the average maximum

(Continued on page 35)

Water Problems of California In Hands of Experts Named by Warren

As this issue of California Highways and Public Works goes to press, preparations are being completed for the state-wide water conference called by Governor Earl Warren for December 6th and 7th in Sacramento.

The purpose of the meeting, in the words of the Governor, is "to explore all phases of water development and use." It is hoped the conference will provide an overall picture of the State's water problems which will be invaluable in seeking the necessary solutions.

The Federal Government, State agencies dealing with water and power problems, California counties and cities, irrigation and reclamation districts, electric power companies and various groups and organizations interested in water and power and flood control will be represented by speakers who will address the conference over which Governor Warren, flanked by his new State Water Resources Board, will preside.

Among the prominent officials scheduled to speak are: Harry W. Bashore, United States Commissioner of Reclamation; Leland Olds, chairman of the Federal Power Commission; Brigadier General Philip G. Bruton, Division Engineer, Corps of U. S. Engineers; Brigadier General J. H. Stratton, Chief, Civil Works Division, U. S. Army Engineers; Richard L. Boke, Regional Director, U. S. Bureau of Reclamation, and Edward Hyatt, State Engineer.

The program for the opening session follows:

Opening Address: Earl Warren, Governor. Edward Hyatt, State Engineer. Subject: "State Water Plan."

Brigadier General Philip G. Bruton, Division Engineer, Pacific Division, Corps of Engineers, U. S. Army. Subject: "Plans of Corps of Engineers for War Department in California."

Richard L. Boke, Director, Region II, United States Bureau of Reclamation, Department of Interior. Subject: "Low Cost Water for California Farms."

S. B. Show, Regional Forester, Region V, Forest Service, U. S. Department of Agriculture. Subject: "Upstream Flood Control Program of the United States Department of Agriculture."

Luncheon will be at Elks Club, at which an address by Brigadier General J. H. Stratton, Chief, Civil Works Division, Office of Chief of Engineers, U. S. Army, on the subject: "War Department's Policies on Flood Control in Sacramento-San Joaquin Valley of California," will be the feature.

Governor Warren will be chairman of conference section meetings on the afternoon of December 6th. He announced section chairmen as follows:

Section 1. North Coast — Chairman, George G. Hoberg, President, Redwood Empire Association, Middletown, Lake County.

Section 2. Sacramento Valley — Chairman, Otto Rohwer, Attorney at Law, Sacramento.

Section 3. San Francisco Bay—Chairman, Ralph Bollman, President, Board of Directors, Contra Costa County Water District, Concord.

Section 4. San Joaquin Valley—Chairman, Harry Barnes, Chief Engineer, Madera Irrigation District, Madera.

Section 5. Mountain Counties — Chairman, Edward J. Reagan, District Attorney, Weaverville.

Section 6. Central Coast — Chairman, Charles L. Pioda, Chairman, Flood Control and Water Conservation Committee, Salinas.

Section 7. South Coast—Chairman, Fred A. Rhodes, City Manager, City of San Diego, San Diego.

Section 8. Colorado River—Chairman, Evan T. Hewes, President, Board of Directors, Imperial Irrigation District, El Centro.

A dinner will be held in the Empire Room of the Senator Hotel on the night of December 6th at which Mr. Olds of the Federal Power Commission will talk on the subject: "Policy of Federal Power Commission on Water Resources."

The program for Friday morning, December 7th follows:

W. A. Smith, President, Supervisors Association of California. Subject: "A County Official Views the Flood Control Problem in California."

Harrison Robinson, President, California State Chamber of Commerce. Subject: "Water Policies of California State Chamber of Commerce."

George Sehlmeyer, Master of State Grange and President of Central Valleys Project Conference. Subject: "Water Resources and Power Development in California."

C. J. Haggerty, Secretary, California State Federation of Labor.

Milton L. Kidd, President, Irrigation Districts Association of California, and California Water Council.

S. B. Morris, Chief Engineer and General Manager, Department of Water and Power, City of Los Angeles. Subject: "Water and Power Problems of California Municipalities."

Arthur T. Evans, Past President, Associated Sportsmen of California. Subject: "Fish, Wild Life, and Recreation."

Neil Cunningham, President, Shoreline Planning Association of California. Subject: "California Beaches."

Luncheon, Empire Room, Senator Hotel 12:15 p.m. Address by the Honorable Harry W. Bashore, Commissioner, U. S. Bureau of Reclamation, Department of Interior. Subject: "California's Stake in National Reclamation."

For Friday afternoon and evening the program will be:

Henry J. Kaiser. Subject: "Industry and the West."

Ray Wiser, President, California Farm Bureau Federation. Subject: "California Agriculture and its Water Problem."

Speakers: To be announced. Subject: "Policies of Electric Power Companies Relative to Water Development in California."

Senator Bradford S. Crittenden. California Joint Legislative Interim Committee on Water Problems.

Open discussion. Five minute talks with privilege of filing for the record papers not to exceed 2,500 words.

Reports of chairmen of geographical sections.

Friday evening, 7:30 p.m., Governor Warren, presiding.

Forum on Administrative Aspects of the Central Valley Project.

Speakers to be called upon, followed by full discussions from the floor.

Adjournment of Conference

GOVERNOR MEETS WITH BOARD

Governor Warren met with his new Water Resources Board in his office in Sacramento on November 1st. After being welcomed by the Governor and hearing brief talks by Director of Public Works C. H. Purcell, State Engineer Edward Hyatt who, by law, is executive secretary of the board, and Senator Bradford S. Crittenden of Stockton, author of the act creating the ageney, the board organized and elected Royal Miller of Sacramento its chairman.

Mr. Purcell and Mr. Hyatt promised the fullest cooperation, Mr. Purcell saying that the Department of Public



Governor Warren meets with his new State Water Resources Board. Left to right, front row: C. A. Griffith, Azusa; State Senato Bradford S. Crittenden, Stockton, Chairman of Legislative Interim Committee on Water Problems; Governor Warren, and Philip D. Swing San Diego. Back row: Howard F. Cozzens, Salinas; Royal Miller, Sacramento, Chairman; B. A. Etcheverry, Berkeley; Lester Ready San Francisco; Roy Meikle, Turlock; State Engineer Edward Hyatt, Executive Secretary of the Board

Works had engineering data on water problems extending back more than three decades which his department would make available to the board.

Members of the board determined by lot the length of their terms which will expire as follows:

Former Congressman Philip D. Swing, San Diego, January 15, 1946; Professor B. A. Etcheverry, University of California, Berkeley, and Lester Ready, San Francisco, 1947; Roy Meikle, Turlock, and Howard F. Cozzens, Salinas, 1948; C. A. Griffith, Azusa, and Miller, Sacramento, 1949. (Thereafter all board terms will be for four years.)

In addressing the board members, Governor Warren said:

PERPLEXING PROBLEMS

"With the inauguration of this State Water Resources Board California has taken another long step forward in accepting State responsibility for the solution of its perplexing water problems.

"In the past numerous boards and commissions have been authorized by the Legislature to deal with specialized water problems on a temporary basis. This is the first time in the history of California that a permanent board has been created, by Legislative enactment, to consider all the beneficial uses of the State's water resources, including irrigation, generation of electric power, municipal and industrial consumption of water and power, repulsion of salt water, preservation and development of wild life resources and recreational facilities.

"The problems which you face as you assume your tasks as members of this newly created board are not, when taken singly, new to our State. In fact, it is probably a conservative statement to say that this State has more water law on its statute books than any other State in the Country. California in the past century has been a testing ground for procedure, both in the legal field and in the construction of works for the control and beneficial use of water. We have witnessed at first hand the gradual evolution of the control and use of our water resources. First, there was the small individual, privately financed, project which disregarded all other considerations save immediate local need. Today we are devoting ourselves to integrated State planning in the face of rapidly increasing demands upon steadily diminishing supplies of water.

FOR FUTURE GENERATIONS

"No matter how prudent we are in California, a time is inevitably approaching when all possible water supplies will be put to use. We know now the growth and prosperity of our State will be limited by the extent to which water can be controlled and used.

"It is the solemn duty of our generation to plan wisely for the greatest possible use for all purposes of every drop of water. Upon such planning will depend the happiness and welfare of millions of people, not only of this generation but of future generations.

"It was recognition of the need for better management of our water resources which caused the planning of the great Central Valley Project, the planning of Boulder Dam, and of

(Continued on page 23)

HIGHWAYS OF CALIFORNIA

By J. D. GALLAGHER, Associate Highway Engineer

This is the third in a series of articles on Highways of California by Mr. Gallagher.—Ed.

A CUSTOM-BUILT HIGHWAY

BACK in 1927, under a grant of $6,000,000 from the Rockefeller Foundation the California Institute of Technology was commissioned to erect an astronomical observatory equipped with the best in instruments and apparatus. The astronomy department of the institute knew what they wanted and began plans for a reflecting telescope equipped with a 200-inch mirror, just twice the size of that on Mt. Wilson, which for many years had been the largest in the world.

On the basis of extensive investigation the institute selected as the location of its "super-observatory" Palomar Mountain in northern San Diego County, some 47 miles easterly of Oceanside and 75 miles northeast of the City of San Diego. The site chosen for the erection of the observatory and other necessary buildings was a plateau at elevation 5,568 near the summit of the mountain. This spot was considered as being most favorable because of the prevalence of clear nights throughout the year, a minimum of turbulence in the upper air, and it was a sufficient distance from interfering glow from lights of urban areas.

SAN DIEGO TAKES INITIATIVE

A condition of the selection of the Palomar Mountain location was that San Diego County provide a road to the observatory site. In turn, one of the first stipulations for construction of the road was that it be adequate for the transportation of material required for the several buildings, heavy machinery and the large mirror.

The San Diego County Road Department took the initiative in meeting the requirements for a suitable road to the observatory site. Provision of the desired road facilitates, however, was consummated by cooperation between the county, the State Division of Highways, and the Public Roads Administration of the Federal Government.

As the old road up the mountain was little more than a primitive trail the county found it necessary to make surveys along a new line over a distance of some 12 miles from its connection with State Highway 195 at Cuca Mesa about 5.3 miles easterly of the settlement of Rincon. Highway 195 is a lateral route in the State System which extends easterly from Oceanside to Morettis near Lake Henshaw.

CUCA GRADE PROJECT

On this State route, the Division of Highways in 1937 reconstructed the 2.8 miles of the Cuca Grade leading up to the mesa from the west, at a contract cost of $40,000. County forces then constructed about nine miles from the State highway across the mesa and up the mountain to Iron Springs Creek and the State, using $306,400 in Federal feeder road funds, completed in 1937 a contract for construction of the last 3.3 miles from Iron Springs Creek to the observatory site.

In addition to the construction of the road up Palomar Mountain and the reconstruction of the State highway approach from the west, the Public Roads Administration reconstructed with $186,000 of Federal land funds over five miles through the La Jolla Indian Reservation to the east and the Pala Indian Reservation west of Rincon. With funds from the same source the Division of Highways surfaced the 3.9 miles through the La Jolla Reservation under a $15,000 contract. The State also reconstructed with prison labor about eight miles of the State highway along the San Luis Rey River between the La Jolla Reservation and Morettis.

FEDERAL AID GIVEN

On the Valley Center Road county forces reconstructed bridges and the old Rincon Grade and oiled the surface between Escondido and Rincon. With $44,500 of Federal aid feeder and county road funds the Division of Highways supervised and let a contract for construction of a steel girder bridge across the San Luis Rey River on this county road about two miles south of Rincon.

During the periods of design of the telescope and its mechanism and of the road construction outlined above, the staff of Cal-Tech conferred with county and State highway engineers to assure that transportation of the large and heavy members of the telescope and observatory buildings could be accomplished without difficulty.

The weight of the moving parts of the telescope totaled 425 tons. For convenience in manufacture and assembly, this was of necessity divided into various pieces. Further division was necessary to meet the limitations of transportation facilities.

HEAVY MATERIAL TRANSPORTED

In 1937 material for the 135-foot diameter dome of the main observatory began to arrive by steamer in San Diego and was transported over the partially completed road to the site. In October, 1938, the metal parts of the telescope arrived at the port. The heaviest of these weighed 54 tons and in size the largest was 24 feet in diameter and 14 feet in height.

On a specially built four-axle low-bed trailer, with two large trucks pulling and a third pushing, the heaviest parts were carried over a carefully selected route to the road up the mountain. The route selected included eight bridges on State highways and two on county roads, all sufficiently modern in design and width to support the unusually heavy loads.

The 12 miles up the mountain naturally presented the steepest grades, but this section had no large bridges. It required about two days for transport of each load over the 75 miles from the ship's side to the observatory. At the time, it was estimated that these loads were the heaviest ever discharged at port of San Diego and the heaviest ever taken over highways in the vicinity.

HUGE MIRROR CONCEALED

The 200-inch mirror was cast in the east and delivered to Cal-Tech in Pasadena for the tedious and exacting job of grinding and polishing. Before this could be completed, however, the war was on and the Pacific Coast threatened with a very real possibility of attack. To prevent the possible loss of this, the world's largest astronomical mirror, it has been stored safely underground for the past four years



This is one of many attractive sections of Mt. Palomar Highway in San Diego County

and just recently has been taken out and the work of grinding and polishing is again in progress. When this is completed, transportation to the top of Palomar will be a relatively simple matter.

The 12 miles of county road from the State highway at Cuca Mesa to the observatory has very aptly been named "The Highway to the Stars." When the scientists of Cal-Tech begin their work of astronomical investigation, many motorists who are normally engrossed in such mundane interests as earning money for the rent may find relaxation and recreation in driving through the heavily timbered sections along this mountain highway up to the clear plateau of the observatory site where they may obtain a glimpse of far away celestial bodies on their courses through the infinite.

THE RIDGE ROUTE ALTERNATIVE

Probably nowhere in the State has the hand of the locating engineer been so ruthless in slashing through on modern alignment, as on the relocation of the Ridge Route, U. S. Highway 99, between Los Angeles and Bakersfield. Probably nowhere in the State is there a better example of the evolution of modern highways since the advent of the motor car.

Prior to 1933, the motorist traveling from Castaic northerly to the floor of the San Joaquin Valley labored and fretted through 48 miles of narrow, tortuous mountain grades culminating in the hairpin turn of the infamous "Deadman's Curve" in Grapevine Canyon. Today he travels only 38 miles between the same points, speedily and safely, unhindered by sharp curvature and unhampered by slow-climbing trucks.

The record of this development as shown by comparison of data on the old and the new routes indicates most clearly the great degree of improvement.

	Old Route	New Route
Length, miles	48.36	37.56
Width, lanes	2	3
Maximum grade, per cent	6	6
Minimum radius curve, feet	70	1,000
Total curvature, degrees	39,441	3,070
Curvature equivalent in circles	109½	8½
Highest elevation, feet	4,234	3,550
Adverse fall, feet	2,220	1,040

With such improvement possible, the questions naturally arise: Why wasn't the latter location chosen in the first place? Why wasn't the earlier road built to better standards? A trite answer might be: Why weren't 1914 cars built like those of today? But the reason is much more complex.

REASON FOR ORIGINAL ROUTE

Even as far back as 1914 when the original Ridge Route was constructed, the engineers knew that a better road could be built. The degree of perfection of any highway in such mountainous terrain, however, is dependent upon an economical balance between costs, money available, and justifiable expenditure.

Many factors require consideration, such as: relative distances, grades, traffic volumes, speeds and types of traffic. For traffic of that day, when there were less than 126,000 cars in the entire State and 35 miles per hour was "wide open," such an investment, as the present road would have entailed, was not justified. Indeed, it would have noticeably depleted money available for improvement elsewhere in the State, at a time when the main objective was to "get out of the mud." So the much more difficult location, later selected for the alternate, was avoided and the original route was built along the ridge to standards typical of mountain highways of that time, following the contours in order to save grading costs.

OLD HIGHWAY OUTMODED

The old highway served for many years. As traffic increased the sharpest curves were widened and day-

lighted, but by 1929 the volume had reached such proportions that further improvement of the old route would have been uneconomical. Reconnaissance surveys and economic studies revealed that a complete new three-lane highway would pay for itself in savings to motorists within 2½ years; finances, however, did not permit immediate construction of the entire project.

Work on the first unit was begun early in 1930. By late 1933 the 27-mile Ridge Route Alternate between Castaic and Gorman was open to traffic and by 1936 the last unit of the Grapevine relocation was completed.

Some of the new route's features are: eight major bridges, four across Piru Creek alone; several miles of channel changes; 5,000,000 cubic yards of excavation; and costs totaling more than 5½ million dollars—are answers why such a road could not have been considered in 1914.

HEAVY EXCAVATION

While the total of 5,000,000 cubic yards of excavation is an indication of the overall size of the grading contracts, a better idea of the enormity of some of the earth moving problems encountered may be had from the fact that, within a center line distance of only 400 feet in Piru Gorge, excavation required the removal of 230,000 cubic yards of material. Literally, that was moving a mountain.

Traffic increased prodigiously with the breaking of the old barrier, both in passenger cars and long-haul trucking. From 2,500 cars and trucks daily in 1933, the volume rose to 4,800 in 1936 and to almost 6,000 by 1941.

Most of the new road was fully adequate for this volume and more, but the Grapevine was not. Its nearly six miles of continuous 5½ per cent grade, with an abnormal uphill speed differential between fast traffic and heavy trucks (20 per cent of the total), and frequent runaway trucks made the Grapevine again one of the most hazardous sections of highway in the State.

WIDENED TO FOUR LANES

To remedy the condition, this section was widened in 1942 and 1943 to four lanes, divided for nearly four of its six miles by a heavy steel barrier rail, and with 3,000 feet of heavy concrete curb on the downhill shoulder to act as a snub for runaway trucks.

Striking view of U. S. 99 as it winds through Piru Gorge south of Gorman





this protection may be rough on tire sidewalls, but it is effective.

At the same time a badly saturated hillside, the scene of many slides which threatened to carry the roadway into Grapevine Canyon was corrected in an unusual manner. A buttress consisting of 180,000 cubic yards of fill was placed on the bottom of the canyon to act as a counterweight in balancing earth pressures exerted by the unstable hillside, and numerous perforated pipes were driven as much as 170 feet into the hill above the highway as drains for ground waters.

DEATH VALLEY

Of all natural attractions within the boundaries of California, the world famous Death Valley in southeastern Inyo County is undoubtedly the most unique. The first recorded story of this ominous wasteland of awesome beauty came from Lewis Manly, who early in 1850 led the remnants of the "Jayhawker" emigrant train over the west side escarpment formed by the towering Panamint Range. The survivors of that ill-fated party of Kansas paused on the summit of the range to look back on the land of their trial, suffering and death only long enough to bestow upon that desert sink the fitting name of "Death Valley."

By Presidential Proclamation in 1933 some 2,500 square miles of desert mountains and valley were set aside as the Death Valley National Monument. Included within the monument boundaries are the 400 square miles of Death Valley proper, a flat, dry, seabed hemmed in by the 6,000-foot Amargosa Range on the east and on



Upper—State Sign Route 90 in Death Valley, looking towards Furnace Creek. Lower—Bad Water, lowest point in United States, 276 feet below sea level. Salt deposits in foreground

he west by the precipitous Panamint Range, where elevations such as the 11,045 feet of Telescope Peak tower above their base as do no other peaks n the United States.

LOWEST POINT IN U. S.

Nearly the whole floor of the valley ies below sea level, with the 276 ele- ation at Bad Water marking the low- st point in the United States. The ea level contour encloses an area more han 70 miles along and from one to ix miles wide.

The winter temperature in Death 'alley is ideal. The summer climate s something else. Accurate metero- gical data in Death Valley has been ccumulated only in recent years. A emperature of 134 degrees in the hade has been recorded at Furnace 'reek Ranch, it should be noted, how- ver, that, that was the limit of the hermometer. Geological Survey doc- ments indicate that a temperature of 50 degrees has been observed around he stone beds at the months of several anyons and out on the salt beds it s estimated the temperature will go 0 degrees higher. The average nnual temperature of 75 degrees indi- ate a most delightful climate, was it ot that the range included in comput- ng this average runs from 15 degrees o 134 degrees.

PROSPECTORS SEEK WEALTH

Following the '49 "Jayhawker" migrants, prospectors were lured into he ranges surrounding the valley by tories of gold, silver, and lead depos- ts, the wealth of which would stagger he imagination. These fabled depos- ts are still missing and still sought. The prospecting, however, did lead to ther mineral wealth, such as the dis- overy of borax, which resulted in the onstruction of wagon roads, railroad, nd the gradual development of the rea to its present status. In this con- ection, the "Twenty-Mule Team" rade mark probably has given Death 'alley more widespread publicity han any other single factor.

Because of the highly mineralized ature of the valley, its formations are ntastic and colorful in the extreme, roviding most interesting and enter- ining scenes.

Prior to its incorporation into the 'ederal System of National Parks and Monuments, there were several so- alled roads throughout the valley. These roads usually followed the bot- oms of washes as the most convenient nd were quite regularly obliterated y summer cloud bursts.

DESERT HIGHWAYS

At about the time the Death Valley National Monument was created, the 1933 Session of the California State Legislature added to the State High- way System some 6,600 miles of roads. Included in these additions were two highways serving as the main entrances to the valley. One of these extended along the east side of the valley from Baker in San Bernardino County through Death Valley Junc- tion; the other, provided a westerly approach from Lone Pine through Darwin.

Improvement of the entrance via Baker and Death Valley Junction involved only typical desert construc- tion, and aside from usual desert drainage problems presented no seri- ous difficulties. The road in from Lone Pine was quite another matter.

From a connection with U. S. 395 about two miles south of Lone Pine, the old road traveled southeasterly through Keeler on the dry Owens Lake bed, to Darwin. This road had long served the mining properties in this section.

In 1926, H. N. Eichbaum, a pioneer resident of the Death Valley country, secured from Inyo County a franchise to build and operate a toll road from Darwin to Death Valley. He built his road along an old trail following down Darwin Wash, in the Argus Moun- tains, across Panamint Sink, over the Panamint Range by way of Towne's Pass and thence down to Stove Pipe Wells in Death Valley.

OLD TOLL ROAD

For the privilege of driving the 31 miles of this narrow dusty road, 20 miles of which was crooked and pre- cipitous with grades of from 15 to 20 per cent, the traveler paid a toll of $2 per car and 50 cents per person.

As soon as the Legislature had incor- porated in the State Highway System a westerly route into the valley, the Division of Highways began negotia- tions for acquiring the Eichbaum fran- chise, which, by way of interest, extended into perpetuity. On Decem- ber 20, 1934, the deed vesting title in the State was filed and tolls abolished.

In the meantime, reconnaissance by State highway engineers developed a line connecting with the old route some distance north of Darwin and following northeasterly along the ridges, in lieu of washes, down the side of Rainbow Canyon to a connection with the old toll road at the floor of Panamint Sink where Darwin Canyon debauches into the sink. The routing, while it involved difficult rock con- struction, eliminated the tortuous des- cent of the Zinc Hill Grade in Darwin Wash. In former days the road down Zinc Hill was subject to annual oblit- eration by cloud bursts.

CURVES ELIMINATED

The distance on the old road from the point of connection north of Dar- win to that at the foot of Zinc Hill Grade was 19.9 miles and included 245 curves. On the present highway the distance is 17.5 miles with only 72 curves. The total difference in curva- ture between the 245 and the 72 curves was more than 8,950 degrees or nearly 25 complete circles; the curves on the old road were also much sharper than those on the revised alignment, the minimum radius on the old route being only 30 feet while on the new the mini- mum radius is 200 feet.

Easterly from the mouth of Darwin Wash, improvement to the route was considerably less difficult. Across the Panamint Sink the going was straight and through Towne's Pass the old alignment was satisfactory. The remainder of this western entrance into the monument to its connection with the Park Road System lies across the flat valley floor and is an excellent highway.

Through regular improvement and maintenance on these two State high- way entrances into Death Valley, motorists have been provided with the means of easy access to this awe-inspir- ing portion of California.

THE YUMA SAND HILLS

Crossing the southeasterly corner of Imperial Valley and lying to the west of the Yuma Indian Reservation is a ribbon of continually shifting sand dunes usually referred to as the Sand Hills, or to be a little more specific the Yuma Sand Hills. The northeasterly end of these Sand Hills is located near Niland and the southwesterly end is south of the border in Mexico.

Since the earliest days of occupation in Southern California, travel across the Imperial Desert has followed a trail through these Sand Hills. The route has always been popular as a link in the most southerly transconti- nental route. At intervals throughout the year, strong winds from the north- west blow across the dunes resulting in a constant movement of the Sand Hills to the southeast.

One peculiarity of the Sand Hills country is that in the middle of the dunes is a small level "Open Valley" about one-half mile wide and 1¼ miles long which is free from sand drifts. This valley apparently has remained in the same place for many, many years, for as late as 1924 there were in place in the valley several old telegraph poles which were reportedly placed there in 1857 by General John C. Fremont as a part of a pole line across the desert.

PLANK ROAD LAID DOWN

Information is quite vague relative to any improvement of the Sand Hill's section of the desert road in the early days when San Diego County extended to the Arizona line or even after the formation of Imperial County in 1907.

In 1916 the California Highway Commission in building the State highway between Yuma and El Centro constructed about 6.5 miles across the ever-moving Sand Hills. From the old "county well" on the westerly edge of the hills a wooden plank road, eight feet wide, was laid on the shifting sands to the westerly end of Open Valley. Through the 1¼ miles of Open Valley a 10-foot roadway was oiled and from the easterly end of the valley to Ramanda at the east edge of the Sand Hills another three miles of plank road was laid on the sand.

This unusual eight-foot plank highway, with its passing turnouts spaced at convenient intervals, or inconvenient to the motorist who had to back-up, served desert travelers for many years. The chief maintenance operation along the plank road consisted of scraping the drifts to the lee side with a team and fresno.

MODERN DESERT ROAD BUILT

In 1924 a new and improved plank highway was laid on two 1,000-foot sections to replace splintered and weathered portions of the old road. The new design consisted of heavy redwood timbers separated by blocks and fastened together with long bolts. This type was considered better than the old flat plank sections held together along the edges with longitudinal boards and wire.

During the years which the two sections of plank highways were serving desert traffic, the State Highway Department was learning quite a bit about desert road construction. In 1926, in order to provide facilities through the Sand Hills which were comparable with other desert highways, 6.5 miles of asphalt concrete pavement were placed on a new grade line as replacement of the old plank road.

The method adopted consisted of constructing a 30-foot graded roadbed to a height which corresponded to the tops of surrounding dunes. The fill was constructed of the only material available: the blowsand of the dunes. While no unusually hard winds were experienced during the contract, the movement of the sand was so continual that it was necessary to take the cross-sections for determination of contract pay-quantities immediately behind the draglines placing the embankment. In fact, a review of this contract revealed three unusual items: "First Blow Off," "Blow On" and "Second Blow Off."

HARD ON ENGINEERS

"First Blow Off" was material which was placed in the allowable embankment, but which, because it was "Gone with the wind," had to be replaced once.

"Second Blow Off" was material in the allowable embankment which had to be replaced twice, and

"Blow On" was material which was blown onto the embankment after con-

This corduroy road carried vehicular traffic across the Yuma sand dunes west of Open Valley in Imperial County for many years following its construction in 1915-16. Note plank turn-out for traffic on left





And this is a view of a section of the modern highway which replaced the old plank road. Slopes in right foreground are constructed to prevent sand drifting over the traveled way

struction and which had to be removed by the contractor before the embankment slopes were oiled.

How the resident engineer and his assistants kept their quantity records for this "put and take" game with blowing sand and at the same time kept their sanity is difficult to imagine.

As rapidly as possible, subgrade was shaped behind the draglines, header boards lined up and the base course of the 20-foot asphalt concrete placed. This required laying planks on the subgrade for travel of the trucks carrying the hot asphalt concrete. As the planks were removed steel plates were laid to support the trucks while dumping.

No difficulty was encountered in laying the surface course, except that the continual deposit of drifting sand required a small crew with hand brooms steadily sweeping up the base immediately in front of placing the top course.

While these construction operations must have left the boys on the verge of nervous collapse, it was a good pavement and undoubtedly the most stable thing in the Sand Hills—it and General Fremont's telegraph poles.

To be Continued.

Maintenance Men Given Red Cross First Aid Course

THE first group of highway maintenance men to be awarded Red Cross first aid instructors' certificates under the new revised techniques finished training November 17th at Redding, California. This is a part of the California State Division of Highway's state-wide program to have all maintenance men ready to give proper first aid care in case of highway accidents.

A new Red Cross first aid textbook, based upon wartime advances in medical science was used in the 30-hour course which gave special emphasis to the type of accidents highway men are most likely to encounter.

Aiming to increase highway safety, the course was given by Red Cross first aid experts at Sacramento, November 26th, at Fresno, December 3d; and at Los Angeles, December 10th. The program was arranged through the cooperation of Ralph E. Carlson, Pacific Area Director of Red Cross First Aid, Water Safety and Accident Prevention; G. T. McCoy, State Highway Engineer; and T. H. Dennis, Maintenance Engineer, Division of Highways.

The men trained in these sessions will in turn train maintenance personnel in the 11 State highway districts. Men who received their instructors certificates at Redding were John A. Copitzky, Assistant Highway Mechanic Foreman of Redding; Laures H. Fretts, Assistant Highway Engineer of Redding; Tollie G. Hinton, Equipment Operator of Cummings; and Frank L. Meyer, assistant to District Maintenance Engineer of Eureka.

A middle aged woman stopped a man on the street and demanded:

"Why aren't you in the army?"

The man, well past the draft age, replied:

"For the same reason you aren't in the Follies."

Bridge Maintenance Practice On California Highway System

By R. A. WAGNER, Associate Bridge Engineer

THERE are 4,636 bridges on the California State Highway System omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is $125,000,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenance and Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the seventh. It deals with Maintenance Problems on Timber Trusses.

THERE are 57 timber truss bridges and nine combination timber and steel truss bridges on the State Highway System, most of which were built many years ago while under County jurisdiction. Maintenance of these county-built structures was assumed by the State when the Highway System was expanded in 1933. Their upkeep and repair has raised many formidable and perplexing problems under present day heavy duty traffic. Many of these bridges were constructed, with untreated timber, at a time when loads were far lighter than they are at the present and, in addition, they are now nearing the end of their service lives.

These untreated timber structures, even when properly maintained, show considerable deterioration with time. Analyses to determine actual stresses under heavy vehicle traffic disclose certain typical and common points of weakness. These weaknesses are generally corrected by strengthening or repairs, but if this work is found to be too extensive or impractical, the bridge is posted for a restricted loading under provisions set up in the Vehicle Code.

Another item of extensive maintenance on timber truss bridges is the repair made necessary by damage resulting from collisions. Such damage may result from collision between two passing vehicles, one or both vehicles being thrown into vital truss members, or more commonly, it results from over-hanging portions of load or body. Damage quite frequently results from excessive height as well as excessive width of load or vehicle.

The conditions described in the previous paragraph give rise to a natural segregation of the maintenance problems on timber truss bridges into three general classes, as follows:

Class 1: Normal maintenance work due to replacement of members resulting from decay or action of wood-destroying insects.

Class 2: Strengthening of any members of the truss bridge in order to increase the live load capacity of the structure. This is done when the needs of traffic are sufficient to warrant strengthening rather than restricting the loading by posting.

Class 3: Replacement of, or repairs to, members damaged due to accidental collision by vehicles.

EXAMPLES OF CLASS 1— NORMAL MAINTENANCE

The principal cause of deterioration to timber truss members is the development of core rot. When untreated timber is used in the construction of bridge trusses, it will usually check, due to progressive seasoning. These checks often occur in the top surfaces of the members and when water enters such checks it can not readily drain out. This develops a condition which is ideal for growth of decay fungus and results in core rot in the bridge timbers. The same conditions also occur due to seepage of water through the joints generally found in composite timber members. Typical of such members is the lower chord of a timber truss which is built up of two or more timbers having staggered splices.

Usually there are no outward manifestations of core rot in a timber truss member and exploratory borings with a hand auger or an electric drill are necessary to discover and locate the extent of such decay. The Bridge Department has special equipment with which to make such borings. This equipment consists of a low speed electric drill, powered by a gasoline engine driven electric generator unit mounted in a station wagon. A sufficient length of extension cord is supplied in order to permit access with the drill to all points on a bridge. Also supplied are a ladder, ropes, and other small tools necessary for this type of investigation work.

CORE ROT TREATMENT

Exploratory holes, using a ⅝-inch diameter drill, are bored into the timber truss members at vulnerable locations as determined by the judgment of the field engineer, these holes later being plugged by ⅝-inch wooden dowels which have been dipped in asphalt mastic.

Core rot is located by a lessening of the resistance of the wood to the action of the drill as well as by examination of the drillings. When such rot is only minor in extent, repairs are not necessary, but the structure is then scheduled for a re-examination at an earlier date than would normally be set. If the core rot in a member has progressed to a point where the remaining cross-sectional area of sound wood is insufficient to safely sustain the total loads, then this member is replaced.

Timber bottom chords of truss bridges are more susceptible to decay than are top chords because they are usually not as well ventilated as are top chords and, in addition to collecting water in the joints, they also collect

along their tops dirt and debris which is thrown from the roadway by traffic. This debris retains the moisture and it is this moisture retention which is the big factor in hastening decay.

DECAYED TIMBER TRUSSES

In replacing decayed timber truss members, the usual underpinning procedure is used, a sufficient amount of camber being jacked into the truss to relieve the stress and free the member. The new timber is cut to exact length, erected and bolted into place, and the underpinning then removed.

The bridge across Rio Hondo on Anaheim-Telegraph Road, State Route 166, in Los Angeles County, consists of eight 60-foot pony Howe truss spans and decay in the bottom chords of the trusses had become so general that it was necessary to underpin the bridge in order to keep it in a condition safe for traffic. **Photograph 1** shows the old lower chord, while **Photograph 1a** illustrates the damage resulting from decay which developed at the timber contact surfaces, a condition which has been pointed out in a previous article.

The spacer blocks, placed between the three lower chord members at the mid-point of the panels, set up conditions favoring decay with the result that the three chord members were almost completely destroyed at this point. Similar conditions also developed at the panel points. The partially decayed timber lower chords were replaced with new all welded, structural steel lower chords. **Photograph 1b** shows the chords after alterations were completed.

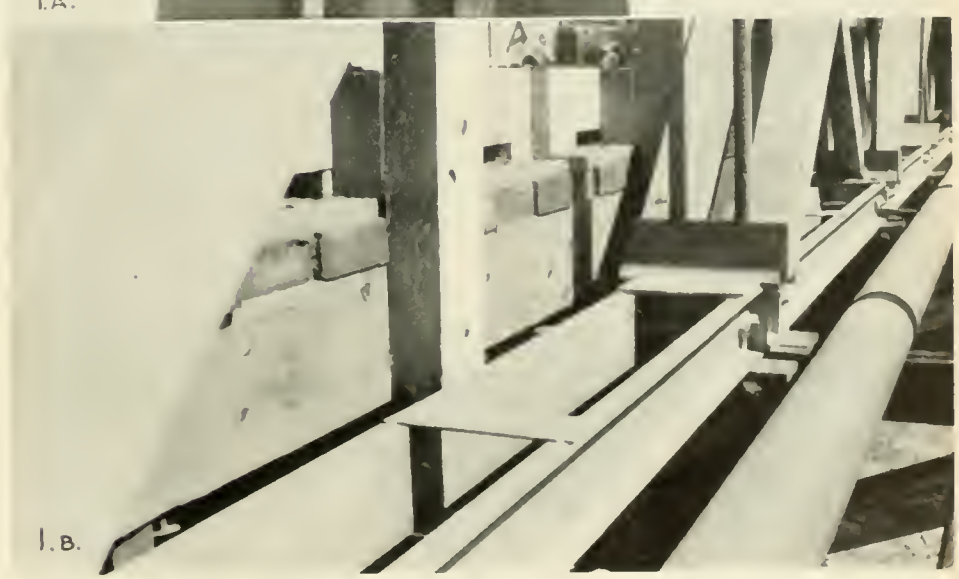
TRUSSES UNDERPINNED

After the trusses were underpinned, the new steel lower chords were placed under traffic by restricting vehicles to one-half roadway width. A heavy timber traveler frame with projecting cantilever beams was used in the remaining traffic lane to support the truss and web members during the time the lower chord was being removed and replaced. In order to relieve the stresses in the members, a truss was jacked into camber, the top chord was then tied to the timber cantilever beams of the traveler and the web members and joint castings were then removed along with the partially decayed timber lower chords.

New structural steel lower chords which had been shop fabricated for half length of the span were then placed, but the shear plates which held the castings were not placed until after the entire lower chord was erected and spliced. These plates were welded across the top of both channels to receive existing truss joint castings, while spreader plates were welded to the top and bottom of channels at mid-panel, in order to retain their spacing. The new bottom chords were spliced at mid-span, using all welded construction with two splice plates per channel.


1


1A.


1B.

VICENTE CREEK BRIDGE

Upon completion of this operation, the shear plates were welded into posi-

tion necessary to give proper camber to the truss; the lower chord castings were reset and the truss reassembled and tightened. The traveler was then skidded along the deck and the remaining trusses were completed by similar operations.

The bridge across Vicente Creek on the Monterey Coast Road, State Route 56, developed core rot in the lower chord splices, causing partial failure at some of these locations. This bridge is composed of a 126-foot timber deck truss with several timber trestle approach spans. As a result of the partial failure noted above, the joints opened up as much as $\frac{3}{8}$ inch to $\frac{1}{2}$ inch, the truss developed a bad sag and the bridge was immediately closed to traffic.

The lower chord of this bridge is about 132 feet above the stream bed and complete underpinning of the span at all panel points was not considered practicable due to high cost of falsework. The canyon has relatively steep sides and the channel under the truss supports is about 42 feet higher than it is at the flow line of the creek. **Photograph 2**, Vicente Creek, as originally built, and **Photograph 2a** show how reinforced concrete footings were constructed on the channel side of each truss tower to support inclined bents.

These bents support the second and third panel points from each end of the truss and, being removed from the channel area, they offer no objectionable restriction to the waterway opening under the bridge. The two central panels of the truss, with minor alterations, continue to act as a span for the central portion.



2



2a

TRUSS TIGHTENING

Tightening timber Howe trusses is a normal maintenance item which is necessary in order to maintain sufficient camber in the spans and to insure proper truss action of all the members. This tightening work is particularly necessary during the early life of a timber truss bridge since it is during this time that most of the shrinkage occurs, and shrinkage is a direct cause of much of this type of trouble. Tightening continues to be necessary at periodic intervals because of progressive shrinkage and compression occurring in the wood. **Photograph 3** shows a State Maintenance crew in the process of tightening one of the Howe trusses in the bridge across the West Fork of the San Gabriel River on State Route 62 in San Gabriel Canyon.



3

EXAMPLES OF CLASS 2—STRENGTHENING

Strengthening of old and weak timber truss bridges is made necessary in order to improve their live load capacities and to bring the general design features into better balance. Completion of tress analysis locates the weaknesses in such structures and if the needs of traffic are such as to make it inadvisable to post the bridge for a restricted loading, then strengthening is considered.

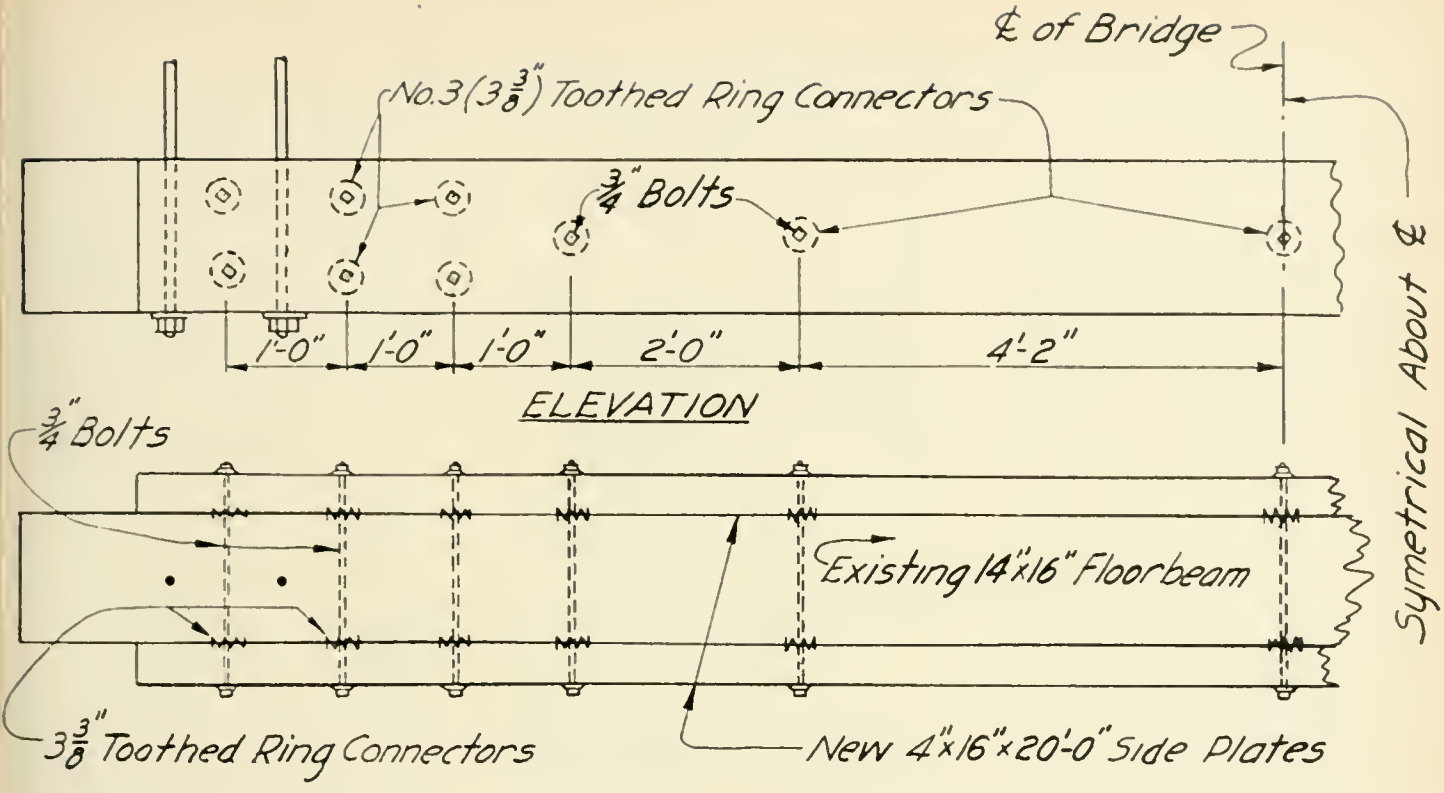


PLATE I

Floorbeams on old timber truss bridges are frequently found to be weak when analyzed under the heavy axle concentrations of present day loads. **Plate I** shows a method used in strengthening such floorbeams on the bridge across Big River on the Mendocino Coast Highway, State Route 56. As noted in this strengthening scheme, timber side plates were bolted to the existing floorbeams and toothed ring connectors were used to develop the shear between the side plates and the existing floorbeam.

RUSSIAN RIVER BRIDGE

The bridge across the Russian River on State Route 70, east of Ukiah, partially failed in the lower chord splices of the 125-foot truss spans. These lower chords are made of three 6-inch-by-12-inch timbers with splices staggered so that only one of the three timbers is joined at any one point. The original splices, which were of the tabled joint type with steel side plates, slipped due to partial failure of the connection. This put the spliced timber out of action and overstressed the other two timbers of the chord member.

In making repairs, it was necessary to provide a detail which would be adjustable and, when tightened, would take one-third of the total stress in the bottom chord of the particular panel in which it was introduced, thus equalizing the stress in the three timbers comprising the lower chord member. This was accomplished by using steel splice plates in conjunction with Teco claw plates and the necessary bolts, angles and adjustable rod features shown in **Plate II**. After the complete detail was assembled, the four rods were tightened sufficiently to cause the stick to take its due portion of the total load in the chord. The advantage of this method of doing the work is that it can be done under traffic without underpinning of the truss. **Photograph 4** shows the splice after completion of such a repair.


4.

DULZURA CREEK BRIDGE

The bridge across Dulzura Creek on State Route 200, between San Diego and Campo consists of two 54-foot pony Howe truss spans. Stress analysis showed the safe load capacity of the bridge to be 14 tons per vehicle, 16 tons per 2-axle truck and 1-axle trailer, and 19 tons per other semi-trailer unit, as governed by the hip verticals (U1-L1). These members consisted of two 1¾-inch round rods, not upset, but by replacing them with

rods of larger size and by doing some other minor repair work, the abovementioned load restriction could be removed. This was done and a bridge having full legal load capacity was provided at relatively small cost.

Some time after the above repair had been completed, it was found necessary to completely underpin the trusses of this bridge because of weakness which developed due to progressive decay in the timbers. This underpinning will support the structure for its remaining service life or until about 1946 or 1947, at which time it is tentatively planned to replace it with a new one on revised local alignment. This method of converting a truss into a trestle and thus carrying a structure along for a few years is a cheap and effective one. It may be used in special cases where the profile and other stream characteristics will permit placing and holding supplemental bents and where the deck and other necessary supporting members are still in such fair shape as to permit their continued use under such circumstances.

EXAMPLES OF CLASS 3—REPAIRS OF ACCIDENTAL COLLISION DAMAGE

The bridge across the West Fork of the San Gabriel River on State Route 62, in the San Gabriel Canyon consists of two 60-foot pony Howe truss spans. In July, 1940, a passenger vehicle struck the south end post of the upstream truss of the southerly span, breaking the endpost and causing this truss to fail.

This type of accident and resulting failure are typical and occur quite frequently in structures of this type. When the truss dropped to the stream bed, the timber lower chord broke at the north end panel, was damaged at the south end panel, a floorbeam was also damaged and a casting cracked. The downstream truss of this span was warped and twisted due to failure and movement of the upstream truss, but no members of the downstream truss were broken. By jacking and supporting on timber cribbing and falsework, the failed truss was raised to proper position, the broken endpost and the damaged casting and floorbeam timber were replaced in kind and the broken lower chord was cut off at the center of both end panels and spliced. **Photograph 5** shows the splice at the north end panel.

The existing lower chords were made up of three pieces of timber. The splice consisted of a total of six scabs, each seven feet in length, one at the top and bottom of each of the three timbers of the chord. A total of forty-eight 4-inch toothed ring connectors between the splice scabs and the parent chord were used with a total of twenty-four ¾-inch bolts in order to develop the splice.

(Continued on page 33)

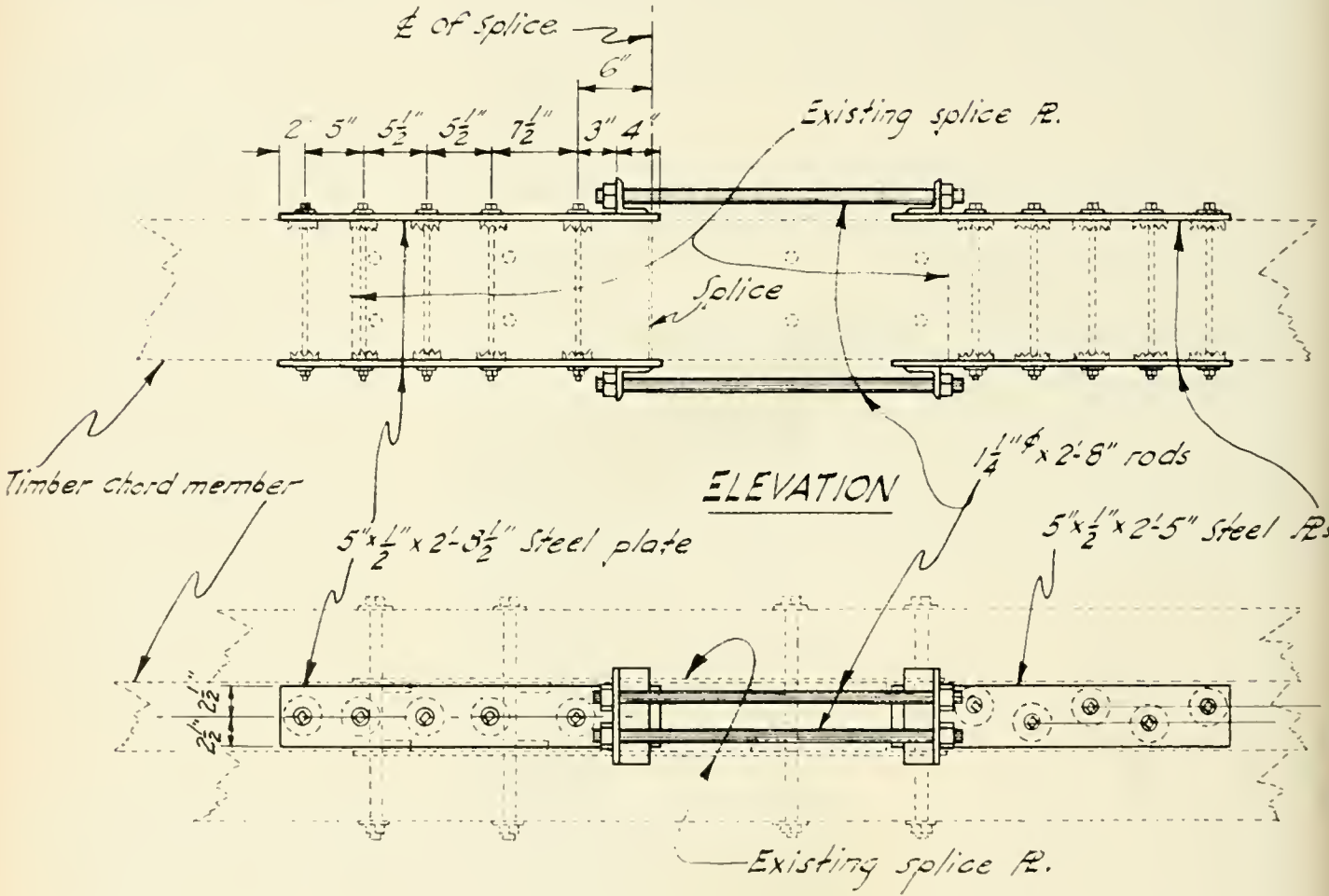


PLATE II

California Enters New Highway Era

By HARRISON R. BAKER, State Highway Commissioner

DUE to the foresight of Governor Earl Warren and the Legislature in making available to the Division of Highways an appropriation of $12,000,000 for acquisition of rights of way and the preparation of plans and surveys for postwar State highway projects, the California Highway Commission, with the war's end, was in a position on September 24th, last, to launch its $115,000,000 postwar road building program.

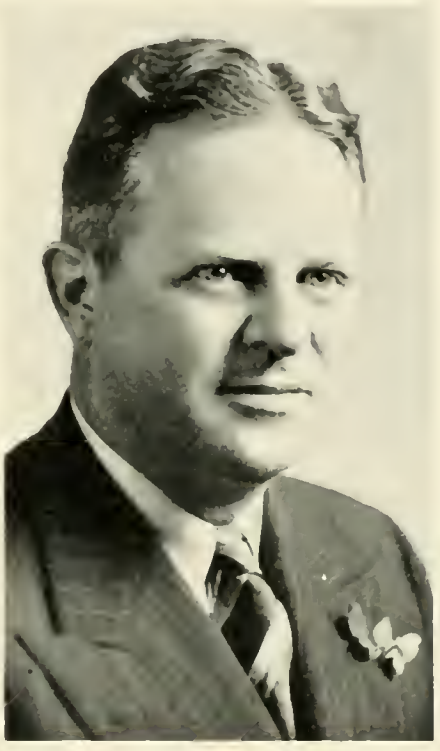
On that date, the commission allocated approximately $48,000,000 for engineering, construction and rights of way to designated highway projects on which bids shall be called for prior to July 1, 1946.

As of November 30th, projects aggregating $14,000,000 have been authorized to be advertised for bids.

During the war, the commission and the Division of Highways strove to keep the State Highway System functioning as efficiently as possible as a vital link in our war effort.

With the coming of peace, it is the duty of these two agencies to carry out a definite postwar highway construction program in order to correct damage caused by excessive wear and tear occasioned by abnormal wartime traffic loads; to provide a large scale public works program against the time when the postwar labor readjustment problem becomes acute, and to raise the standards of the California Highway System to a point commensurate with the needs of the greatly increased population of the State and the increasingly complex demands of growing traffic requirements—with particular attention to the necessary solution of traffic problems in congested metropolitan areas.

The Division of Highways has estimated that it will require $695,000,000 over a 10-year period to correct critical deficiencies in the State Highway System and to build the nucleus of a needed freeway system in our metropolitan districts. Anticipated revenues for this 10-year period are only about $240,000,000, wherefore some additional highway financing must be provided to defray the cost of this necessary highway construction.



HARRISON R. BAKER

It is estimated freeways needed to solve metropolitan traffic problems will require an expenditure of $285,000,000.

In the past, California has been generous with highway funds and will continue to be. Since the first State Highway Bond Issue in 1909, when the people voted $18,000,000, to June 30, 1945, a total of $829,369,837 has been spent on our highways. Every California citizen is a stockholder in this great enterprise.

From early pioneer days, when the Forty-niners crossed the Sierras, the Mormons trekked across mountain trails and the Mojave Desert to settle in San Bernardino and the Jayhawkers fought starvation and thirst in Death Valley, the development of California has gone hand in hand with the development of our highway system.

California has grown up in the motor age. Our economy, predominately agricultural before the war and transformed in four years by industrial progress equivalent to 50 years of normal growth, is dependent upon the proper functioning of our highway facilities.

California is the first State in the Union in the number of motor vehicle registrations and now ranks third in population, yet is forty-fifth among the 48 States in the average annual cost to the motorist of license fees and fuel taxes per motor vehicle.

In California, with a 3-cent gasoline tax, the average annual cost to the motorist is $25; in New York with a 4-cent gas tax it is $40 and in Florida with a 7-cent gas tax it is $65.

Highway transport in California is entering upon a new era, calling not merely for improvement but for a revolutionary forward step in transportation.

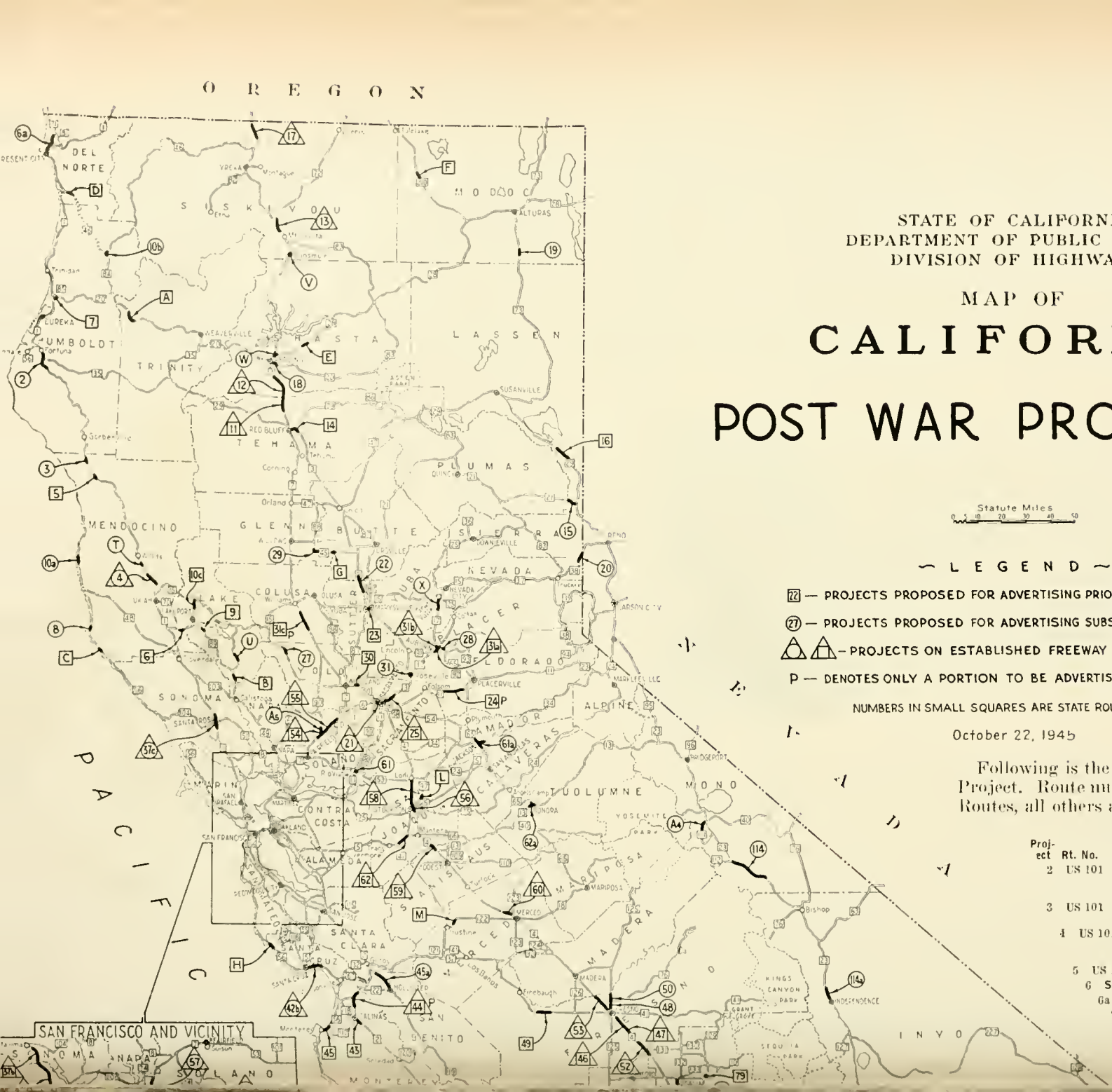
Future highway distances will be measured in time—in minutes, not miles.

Freeways are a new factor in motor transportation. Their growth will have an important influence on the lives of all of us who reside in or have business or social relationships with our metropolitan cities.

That our present State Highway System is outmoded due to financial inability to keep it abreast with the development of the motor vehicle and the demands of modern fast traffic and population increases must be admitted.

California faces a new and a bright future. To assure its full attainment we must make steady progress with our highways. We must keep the gains we have made and build upon this foundation.

Remember the Chinese proverb:
"It Is Later Than You Think."



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

MAP OF

CALIFORNIA

POST WAR PROJECTS

Statute Miles

— LEGEND —

22 — PROJECTS PROPOSED FOR ADVERTISING PRIOR TO JULY 1, 1946

27 — PROJECTS PROPOSED FOR ADVERTISING SUBSEQUENT TO JULY 1, 1946

— PROJECTS ON ESTABLISHED FREEWAY

P — DENOTES ONLY A PORTION TO BE ADVERTISED PRIOR TO JULY 1, 1946

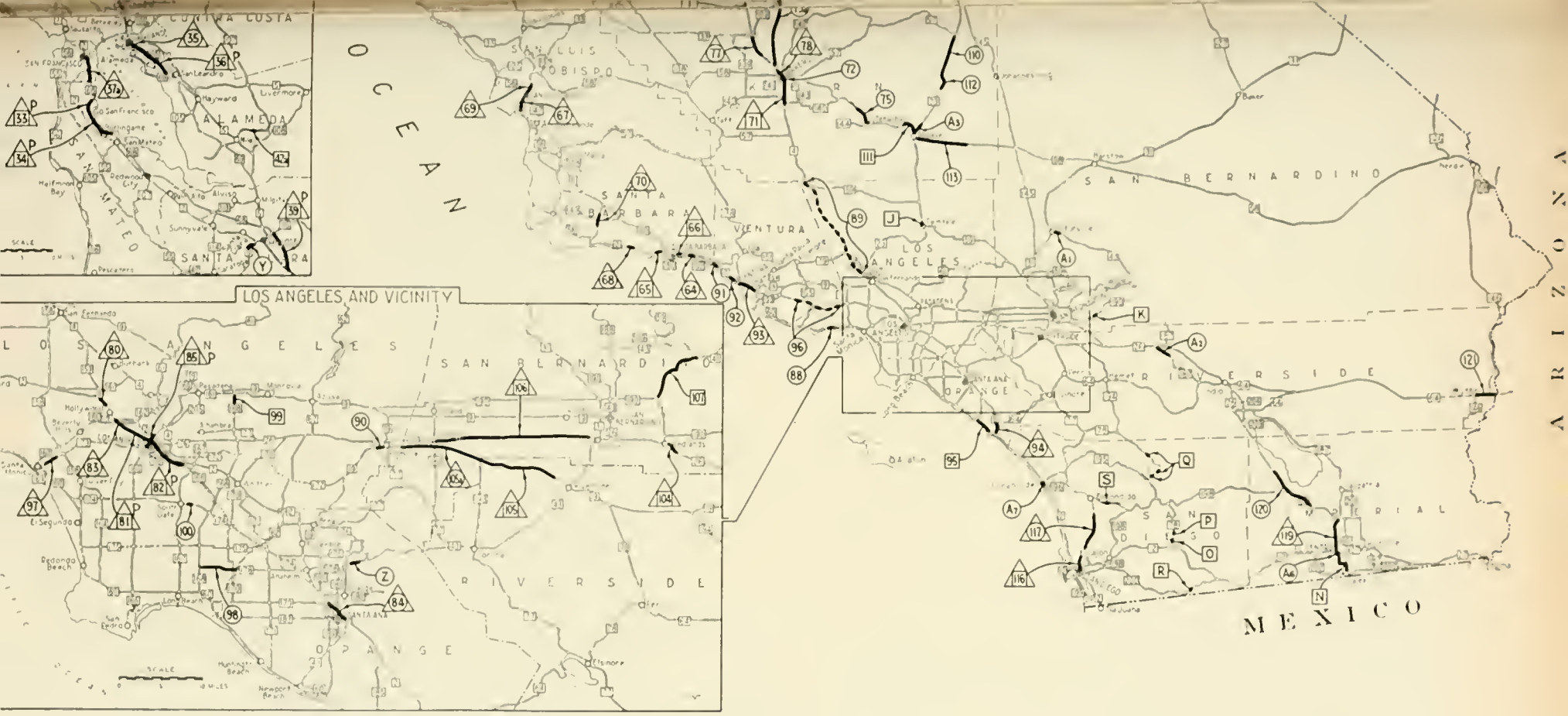
NUMBERS IN SMALL SQUARES ARE STATE ROUTE NUMBERS

October 22, 1945

Following is the key to the map of California Postwa
Project. Route numbers in boldface are Legislative Stat
Routes, all others are State Sign Routes or U. S. Routes

POSTWAR CONSTRUCTION PROGRAM

Project	Rt. No.	County	Description	Approximat Length, Mile
2	US 101	Humboldt	North Scotia Br. to 16th St. in Fortuna; NW. P.R.R. Overhead, Strong Creek Br.; Van Duzen Overflow Br.	8.0
3	US 101	Humboldt	Red Mountain Creek to Piercy (Portions); Sidehill Viaduct	4.6
4	US 101	Humboldt	1.5 Mi. S. of Forsythe Creek Br. to Ridgewood Sommit, Forsythe Creek Br.	10.2
5	US 101	Humboldt	Rock Creek Br. and Approaches	0.6
6	SR 16	Mendocino	Dooley Creek Br. and Approaches	0.1
6a	US 101	Humboldt	Roote 1 to Smith River	5.6
7	US 299	Humboldt	Mad River Br. and Approaches	0.2
8	29	Mendocino	Alder Creek Br. and Approaches	0.2
9	1	Lake	Kelsey Creek Br. and Approaches	0.6



No.	Route	County	Description	Approximate length, miles
10(a)	1	Mendocino	Mitchell and Hare Creeks, Bridges, and Approaches	2.5
10(b)	96	Humboldt	Klamath River at Weitchpec, Bridge and Approaches	0.6
10(c)	29	Lake	1.2 Mi. North of Rodman Narrows Road to Route 15; Scott and Robinson Creeks, Bridges	2.0
A	US 299	Trinity	New River Bluffs to Cedar Flat	
B	29	Lake	At St. Helena Creek	0.7
C	1	Mendocino	At Slick Rock Creek	0.9
D	SR 218	Del Norte	At Turwar Creek	0.7
T	US 101	Mendocino	NW.P.R.R. to Underpass	
U	29	Lake	1.3 to 5.9 Mi. NE. Putah Creek	
11	US 99	Tehama	6 miles north of Red Bluff to North County Line	7.1
12	US 99	Shasta	South county boundary to Clear Creek; Anderson and Spring Creek Bridges	10.7
13	US 99	Siskiyou	Spring Hill to Weed; S.P.R.R. Overhead	8.0
14	US 99E	Tehama	Cone Lane to Red Bluff; Samson and Sand Slough, Paynes Creek and Salt Creek Overflow Bridges	2.8
17	US 99	Siskiyou	Camp Lowe to Bailey Hill; S.P.R.R. Underpass	7.8

No.	Route	County	Description	Approximate length, miles
15	24	Lassen	West County boundary to Route 29; W.P. R.R. Overhead	4.2
16	US 395	Lassen	Bird Flat to Doyle	7.5
18	44	Shasta	Sacramento River Bridge and approaches and A.C.I.D. Canal Bridge	1.3
19	US 395	Modesto	South Fork of Pit River Bridge	0.1
E	US 299	Shasta	At Seamans Gulch	
F	139	Modoc	Cornell to Stronghold Culverts	
V	US 99	Siskiyou	North approach to Dunsmuir	
W	US99-299	Shasta	Sulphur Creek to Boulder Creek, Underpass Jct. Rts 3 and 28	
20	US 40	Nevada, Sierra	½ Mile North of Farad to ¾ Mile South of Nevada State Line	3.0
21	US 40 US 99W	Yolo	Washington Underpass and Approaches	0.5
22	US 99E	Sutter, Butte	Lomo to 0.4 Mile South of Fagan	8.0
23	US 99E	Yuba, Sutter	Feather River Bridge and Approaches	2.5
24	US 50 US 99E	Placer	2½ Miles East of Clarkesville to 1¼ Miles West of El Dorado	8.2
25	US 40	Sacramento	North Sacramento Viaduct to ½ Mile East of Ben Ali	4.1
31	US 99E	Placer	Roseville Underpass and Approaches	0.7

No.	Route	County	Description	Approximate length, miles
31(a)	US 40	Placer	0.1 Mile West of Nevada Street in Auburn to 1.0 Mile East of Auburn; East St. Undercrossing, S.P.R.R. Grade Separation, and Walsh St. Separation	2.6
31(b)	49	Placer	Junction New Route 37 in Auburn to U.S. General Hospital; S.P.R.R. Grade Separation	3.5
31(c)	US 99W	Colusa	Arbuckle to 4 mi. South of Williams; Salt Creek, Sand Creek, N. Branch Sand Creek, Rosina Draw and Cortina Creek Bridges	6.4
27	16	Yolo	0.4 Mile North of Rumsey to 0.8 Mile South of Rumsey	1.2
30	16, 24	Yolo	Tule Canal Bridge and Approaches	1.3
28	49	Placer-El Dorado	North Fork American River Bridge and Approaches	0.2
29	SR	Glenn	¼ Mile West of Sacramento River to Butte City; Sacramento River Bridge	0.6
G	SR	Glenn, Butte	At Big Butte Creek	-
X	49	Nevada	1.5 Mi. N. Rattlesnake Creek to Grass Valley	-
32	US 101	Marin	Ignacio to North County Boundary	8.5
33	US 101 Bypass	San Mateo	North City Limits of South San Francisco to 0.3 Mile South of S.P. Underpass	2.0
34	US 101 Bypass	San Mateo	0.3 Mile South of S.P. Underpass to Peninsular Avenue, San Mateo	6.6
39	US 101	Santa Clara	Santa Clara Ave. in San Jose to Ford Road	8.1
41	US 40	Contra Costa	Junction Rts. 69 and 14 to North City Limits of Richmond	1.9
37(a)	US 101 Bypass	San Francisco	In San Francisco, South City Limits to Fifth Street	5.2
37(b)	US 101	Sonoma	South County Boundary to 1 Mi. S. of Petaluma	3.0
37c	US 101	Sonoma	0.3 Mi. S. of Santa Rosa to 1.7 Mi. N. of Santa Rosa	3.7
35	SR 69	Alameda	6th and Oak Streets to Hight Street in Oakland	3.3
36	SR 69	Alameda	South City Limits of Oakland to High Street	2.9
42(a)	SR 107	Alameda	Alameda Creek at Brightside, bridge and approaches	0.7
42(b)	1	Santa Cruz	Aptos to Santa Cruz	6.0
42(c	24	Contra Costa	Jct. Rts. 76 and 106 in Willow Pass to near Pittsburg	2.3
H	1	Santa Cruz	At Waddell Creek	-
Y	17	Santa Clara	Bascom Ave. to Park Ave.	-
43	US 101	Monterey	2 Miles South of Salinas to Salinas	1.9
44	US 101	Monterey	Santa Rita to Pestoni Grade	11.0
45	1	Monterey	Del Monte Junction to Seaside Junction	3.0
45(a)	25, 156	San Benito	Hollister to Santa Clara County Line	9.2
64	US 101	Santa Barbara	Sheffield Drive to San Ysidro Road; Romero, San Ysidro and Oak Creek Bridges	1.3
65	US 101	Santa Barbara	Hollister Wye to Elwood Overhead	9.2
66	US 101	Santa Barbara	Park Place to Rancheria Street	2.3
67	US 101	San Luis Obispo	Miles Station to San Luis Obispo	5.8
68	US 101	Santa Barbara	Las Varas Creek to ½ Mile East of El Capitan Creek	2.9
69	US 101	San Luis Obispo	San Luis Obispo to Cuesta	2.7
70	US 101	Santa Barbara	Santa Ynez River to Jonata Park; Santa Ynez River Bridge	3.9
46	US 99	Fresno	Calwa Overhead to Church Avenue	2.1
47	US 99	Fresno	South City Limits of Fowler to Calwa Overhead	6.3
52	US 99	Fresno	South County Boundary to Selma (See VI-Tul-4-E, Primary South)	4.7
53	US 99	Fresno	Clinton Avenue to San Joaquin River	7.2
48	41	Fresno	Shields Avenue to Fairmount Avenue; Gould Canal Bridge	1.9
49	180	Fresno	San Joaquin River Overflow Bridges	1.4
50	41	Fresno	Fairmount Avenue to Herndon Avenue	2.1
51	41	Kings	5th Standard Parallel to 1.2 miles North	1.5
52	US 99	Tulare	0.3 Miles South of County Line to County Line (See VI-Fre-4-D, Kngb. A. Primary North)	0.4
71	US 99	Kern	10.8 Miles to 1 Mile South of Bakersfield	9.8
72	US 99	Kern	1 Mile South of Bakersfield to North City Limits; Union Ave. Underpass widening	3.2
77	US 99	Kern	Cawelo to Famoso	6.7
78	US 99	Kern	Bakersfield to Snow Road; Minkler Underpass, Oil Junction Overhead, 5 small structures	3.5
73(a		Kern, Tulare	Route 4 to Ducor	23.4
75	US 466	Kern	Keene to Tehachapi; 2 railroad grade separations	10.2
76	SR 132	Tulare	Packwood Creek to Rt. 10	2.3
79	65	Tulare	Yokohl Creek Bridge and Approaches	0.5
1	US 99	Tulare	At White River Sink	-
80	US 101	Los Angeles	Barham Overpass to Vineland; Lankershim Grade Separation	1.6
81	US 101	Los Angeles	Alhso Street Bridge to Vermont Avenue	4.1
82	US 101	Los Angeles	Downey Road to Alhso Street Bridge	4.2
83	US 101	Los Angeles	Vermont Avenue to Highland Boulevard	3.4
84	US 101	Orange	First Street in Santa Ana to 0.1 Mile North of Santiago Creek Bridge	2.6
88	US 101 ALT	Los Angeles	Latigo Canyon to Malibu Creek	4.0
89	US 99	Los Angeles	Ridge Route, Tunnel Station to North County Boundary (portions)	6.1
91	US 101	Ventura	At Long Wall North of Ventura	1.2
92	US 101	Ventura	Ventura River to S.P. Overpass	1.0
93	US 101	Ventura	El Rio to Ventura	6.0
94	US 101	Orange	Doheny Park to Trabuco Creek	0.9
95	US 101 ALT	Orange	Laguna Beach to Dana Point; San Juan Creek Bridge	5.3
96	US 101	Los Angeles, Ventura	Calabasas to Newbury Park (portions)	4.7
85	US 6, US 66, US 99, 11	Los Angeles	Harbor Freeway from Adobe Street to Fifth Street.	1.2
90	SR 19	Los Angeles	Route 77 to Pomona	0.7
97	26	Los Angeles	Olympic Boulevard, Bundy Drive to Lincoln Boulevard	2.3
98	18	Los Angeles	Lakewood Boulevard to South County Boundary	4.0
99	19	Los Angeles	Huntington Drive to Colorado Street	1.1
100	10	Los Angeles	Los Angeles River Bridge and Approaches	0.6
J	US 6	Los Angeles	Palmdale R.R. Crossing	-
Z	18	Orange	Santa Ana Canyon Rd., Peralta to Olive Cutoff	-
104	US 70, US 99	San Bernardino	State Street to East City Limits of Redlands	2.8
105	US 60	Riverside	1 Mile East of Mira Loma to 3.0 Miles West of Riverside	5.2
105 a	US 60	San Bernardino, Riverside	Los Angeles County Line to 1 Mile East of Mira Loma	12.2
106	US 70, US 99	San Bernardino	Ontario to Colton	16.5
107	SR 207	San Bernardino	Route 190 to Route 43 (City Creek Road	16.4
K	SR 190	San Bernardino	At Mill Creek	-
A1	18	San Bernardino	1 Mi. E. Victorville to Victorville	-
A2	111	Riverside	Whitewater Pt. to ½ Mi. N. of Palm Springs and Approach to 3 Bridges	-
110	US 6	Kern	Ricardo to Freeman Station	16.7
112	US 6	Kern	Cinco to Ricardo	5.3
113	US 466	Kern	Mojave to Muroc Junction	9.9
114	US 395	Mono	Rock Creek to Casa Diablo	18.5
114 a	US 6, US 395	Inyo	Independence to Division Creek	9.9
111	US 466	Kern	Cameron to Mojave	7.2
A3	US 6	Kern	Mojave to 4.8 Mi. North	-
A4	SR 111	Mono	Grant Lake to Rt. 23	-
54	US 40	Solano	Ulatis Creek to Midway	6.0
55	US 40	Solano	Midway to 1 Mile North of Dixon	6.1
56	US 99	San Joaquin	Junction Mariposa Road South of Stockton to Calaveras River and Wilson Way to Rt. 4	-
57	US 40	Solano	Vallejo Wye to N. of Junction with Rt. 208	5.3
58	US 99	San Joaquin	Calaveras River to Lodi	8.4
59	US 99	Stanislaus, San Joaquin	Salida to 0.5 Mile North of Ripon; Stanislaus River Bridge	4.5
60	US 99	Merced	Black Rascal Canal to Buhach Station	3.8
62	US 50	San Joaquin	Grantline Road to Mossdale; San Joaquin River Bridge	3.7
62 a)	49, 108	Tuolumne	Stockton Street entrance to Sonora, Solinsky St. to Washington St.	0.4
61(a)	88	Amador	In Jackson; 0.5 Mile North of Rt. 65 to Junction Rt. 65. (Portion of project 61(a) in Secondary North)	0.5
61(a)	49, 88	Amador	South of Jackson to East of Jackson Portion of project 61(a) in Primary North	1.8
L	88	San Joaquin	At Calaveras River	0.3
M	140	Merced	Mud Slough Bridge-Garzas Creek	0.1
A5	SR 90	Solano	Rt. 7 to ½ mi. N. of Sweeney Creek	-
119	US 99	Imperial	El Centro to Brawley	12.9
120	US 99	Imperial	Trifolium Canal to 2 miles north of Sandy Beach	15.2
121	US 60, US 70	Riverside	4 miles west of Blythe to State Line	7.7
116	US 395	San Diego	"A" Street to ½ mile north of San Diego City Limits	6.9
117	US 395	San Diego	Miramar to Lake Hodges	12.2
N	US 99	Imperial	Calexico to El Centro	-
O	79	San Diego	At Samagatuma Creek	-
P	79	San Diego	At Descanso Creek	-
Q	79	San Diego	At Acorn Valley, Matagual Valley and Canada Verde Creek	-
R	94	San Diego	At Campo Creek	-
S	78	San Diego	At San Dieguito River	-
A6	US 80, US 99	Imperial	Jct. Rts. 12 and 26 via Adams Ave. and Fourth St. to Rt. 27	-
A7	US 101	San Diego	Wisconsin St. to 8th St.	-

Eel River Training Jetties at Shively Bluffs Combat Floods

By L. R. REDDEN, Office Engineer

IN its efforts to adequately maintain those portions of the Redwood Highway bordering the Eel River in Humboldt County, the State has found it necessary during the past two decades to construct numerous protective devices against the erosive action of the river's flood waters. The seriousness of the problem can be well realized when it is understood that high water stages of 40 feet and more above low water flow are not uncommon which, taken in combination with extremely high velocities of flow, result in extremely rapid and destructive erosion.

Several types of protection have been installed depending on the conditions peculiar to the individual location. These have included sacked concrete riprap, heavy rock riprap, pile and cable fence, rock-filled flexible wire mattresses, and, most recently, permeable pile jetties. This last type was constructed last year at Dyerville, at the confluence of the South Fork of the Eel River with the Main Eel. The results obtained there have been so encouraging that a similar installation is now being made at Shively Bluff, about seven miles downstream.

PROGRESSIVE EROSION

A progressive and accelerating erosion condition at Shively Bluff has finally reached the point where some damage to the embankment slopes has been caused by the river during the past two or three years of moderate flood stages. Should a heavy winter and attendant heavy runoff occur there is grave probability that the entire road would be washed out. The permeable jetties being installed at Shively Bluff will serve as a preventative against such an eventuality.

The primary function of a permeable pile jetty is to sufficiently reduce the velocity of flow of a stream in flood stage so that it is below the velocity (1) where erosion or washing away of the natural river bank takes place, and (2) where the river will no longer carry down the stream its bed load of sand and gravel particles but instead will deposit them to form a protective and gradually growing bar above the jetty. Over a period of time the bar becomes large enough to turn the course of the stream away and thus provide protection against erosion of the original river bank.

OPEN JETTY

In order to accomplish a reduction in velocity, as opposed to a complete

View of site of jetty installation just upstream from Shively Bluff. Piles in the two upstream jetties have been driven. Chad Creek enters the river in the right foreground



stoppage of flow, the jetty is purposely constructed very open. It consists essentially of two to three rows of piles on which are strung barbed wire. The rows of piles are 6 feet to 8 feet apart; the piles in each row are 8 feet apart; and the wire is strung horizontally at 6 inches to 12 inches centers. The rows extend into the stream perpendicular to the direction of flow.

The resistance to flow presented by the widely spaced piles and the wire, on which small debris will impale itself, is designed to be open or "pervious" enough to readily permit flow of flood waters, but still offer sufficient obstruction to the current so that it will be reduced to less than that critical velocity at which the force of the water carries along with it considerable quantities of sand and gravel on the bottom or bed of the stream. Thus the stream is induced to deposit this bed load above and below the jetty forming eventually into the characteristic sand and gravel bar so familiar to us all.

One item to guard against is the setting up of eddy currents so large in magnitude as to overcome the moderating effect on the current. Thus, placing the piles too close together, plus the greater likelihood of debris lodging against them, causes the jetty to act like a dam, as a consequence of which disastrous eddy currents are set up, scouring occurs, and the desired result is not obtained.

FOUR JETTIES AT SHIVELY BLUFF

The Shively Bluff installation consists of four jetties which are being installed at a bend in the river. Beginning at the upstream end, the jetties are spaced 255 feet, 300 feet and 355 feet apart; and they extend into the river distances varying from 127 feet to 312 feet, with the outer end conforming to a predetermined curving "line of influence." It is expected, after construction, that eventually the main current at high water stages will conform to this line of influence. To minimize the effects of eddy currents at the outer end of the jetties, wing extensions, set at 30 degrees to the designed line of flow, are being constructed.

Three of the jetties consist of two lines of piles 6 feet apart. The fourth or upstream jetty consists of three lines of piles, the two upstream lines of which are 6 feet apart, and the third line 8 feet downstream from the second. The additional line in the upstream jetty, which receives the first impact of the stream, provides added resistance against the current. Wales and braces bolted near the tops of the piles, and diagonal bracing in the case of the upstream jetty, provide additional strength.

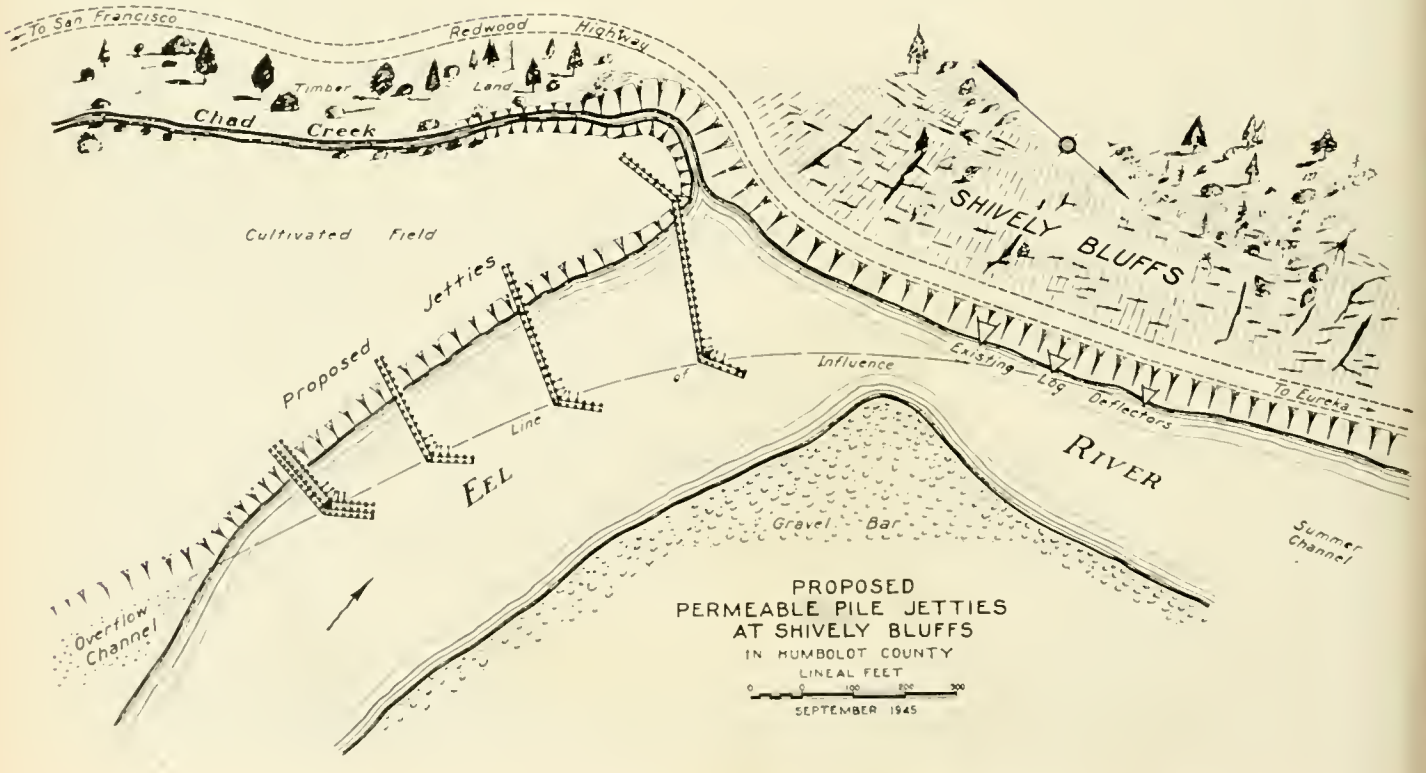
At the point where the wing extension joins the main jetty five additional piles are being driven as brace piles, with cut off 2 feet above stream bed. Diagonal bracing to the line piles gives added strength to the angle point where considerable stress and strain is anticipated.

PROTECTION AGAINST HEAVY DRIFT

The "cut-off" elevation for the river bed section of each jetty provides for a gentle slope down on a uniform grade away from the bank, with the outer end variously 2 feet to 9 feet lower than the inner end. The piles extend 9 feet to 15 feet above the bed of the river, depending on its contour. Heavy rock riprap is placed around the piles 2 feet to 3 feet thick to minimize "bed" scour around the piles.

The question may occur as to why the piles in the jetties extend only 9 feet to 15 feet above the river bed, while the extreme high water is 40 feet or more above low water stage.

This is done so that heavy drift most common at maximum stage may float over the jetties without damaging them. Such drift sometimes consists of entire redwood trees as much as 300 feet long and 10 feet or more in trunk diameter. Such enormous trees possess a terribly destructive force when carried swiftly by the current,





View of permeable pile jetties constructed during 1944 at Dyerville. Area between jetties, as well as area downstream from near jetty has filled in several feet as result of one winter's deposition

hence the importance of providing adequate clearance over the jetties. If debris of such magnitude struck against a jetty, failure would be a foregone conclusion. Moreover, the primary function of the jetty, as above explained, is to induce and encourage the formation of a gravel bar from the bed load carried by the stream, and hence no useful purpose would be served by extending it up to maximum flood elevation. As a matter of fact such construction might only insure the failure of the jetty from the destructive forces of the current, if not from drift.

GRADE OF JETTY

From the inshore end of the riverbed section, and structurally a continuation of it, the grade of the jetty rises steeply, conforming approximately to the slope of the bank, and extending above it 6 feet to 15 feet. At the top of the bank the grade again changes, with the top of the jetty being level, and about 5 feet above the ground. The three upstream jetties extend back of the top of the bank 25 feet to 30 feet to effect an anchorage; the fourth jetty extends 128 feet back of the top of the bank to minimize the influence of a small stream which enters the river immediately down stream from jetty.

Barbed wire is to be strung at 8 inch centers on the upstream row of piles in each jetty, and the placing of medium to heavy rock riprap around the piles to prevent erosion completes the installation.

The work is being done by Mercer-Fraser, Contractor, at a bid cost of $40,751. H. M. Hansen is Resident Engineer for the State. The work is located in District I of the Division of Highways, whose headquarters is Eureka. C. P. Sweet is District Construction Engineer and A. M. Nash is District Engineer.

Water Problem in Expert Hands

(Continued from page 4)

the All-American Canal. It was the recognition of need which inspired so many other programs within our State. On this occasion we have a larger objective before us—the objective of developing an over-all program covering all our State water problems.

"The main objective of this board is to be the orderly development of a water plan for our entire State—a plan which gives sympathetic consideration to the needs and opportunities of every community—a plan which gives consideration to the fullest possible use of all the water in all our streams.

GIGANTIC PROBLEM

"Quite naturally, in a State as big as ours, there is no simple and immediate answer to be found to many of our water problems. Water is by nature a local as well as a state-wide problem and as a result we find, in any attempt at state-wide planning, many viewpoints and approaches to consider.

"It seems to me, therefore, when we are dealing with such a gigantic and intricate problem we should approach it by first getting the view-

(Continued on page 31)

Record Storm Hits District IX

By J. M. Hodges,
District Maintenance Engineer

DISTRICT IX is definitely a cloudburst area, and it is not uncommon for the highways of this district to suffer severe damages at several locations during the late summer season. The first weekend in October of this year produced a series of recurring storms throughout the Mojave to Lone Pine area which resulted in loss of life and heavy damage to U. S. Highway Routes 6, 395 and 466.

The only verified loss of life occurring near the highway was at the Cameron Dip near Mojave, where a car towing a trailer attempted the crossing after being warned not to do so, and was swept away downstream, resulting in the death by drowning, of a child. Two elderly people, long-time residents in the solitude of Indian Wells Canyon, were swept with their homes down Indian Wells Canyon and their bodies recovered from the sands not far below the highway. Despite numerous apparently-authentic reports of cars and occupants being completely covered, there have been no other substantiated instances of further loss of life during these storms.

DAMAGE $250,000

Final and complete determination of the extent of restoration protective works have not yet been made, but it is estimated that actual storm damage occurring during this one weekend was approximately $250,000.

A general rainstorm covered most of Southern California beginning Friday, October 5th. The first storm of cloudburst proportions struck the area between Red Rock Canyon and Little Lake on Saturday, temporarily closing the road at numerous locations and isolating groups of traffic at each wayside point. This traffic had only barely moved out and on before another torrential downpour struck the same area, and between the wider limits from Mojave to Lone Pine. This storm, which resulted in an unprecedented amount of debris ranging from sand to house-size boulders and trees, caught a number of cars



Top—This photo shows bus washed 1,000 feet from highway on State Route 23 in Inyo County. Center—Mud and boulders flowed over roadbed on State Route 23 in Kern County. Bottom—Shovel at work locating debris-covered roadway on State Route 23 in Kern County

marooned in the previous day's flooded areas and washed them on across the highway and as far as one mile beyond the highway.

VEHICLES WASHED OFF HIGHWAY

Two trucks and trailers loaded with oil were carried away and overturned by the Indian Wells Canyon flood and an empty passenger bus was swept downstream one-half mile without turning over; three automobiles and a small truck were washed from the highway for varying distances to remain buried in the mire until it had dried sufficiently to enable them to be towed away.

Monday morning's single cloud resulted in a sudden rainfall of such violence as to renew the mud flow at each and every location throughout more than 100 miles of main line

highway. The rains of Tuesday and Wednesday were distributed over a much wider area including Death Valley and our Deep Springs territory, but they were only threats of possible repetition of disaster along U. S. Routes 6 and 395 to Reno.

PROTECTION WORKS

Considerable run-off carrying sand is a normal expectancy throughout the damaged section and numerous allotments had been expended in protection work over a number of years. This protection work has ranged from ditches and dikes, various types of paved dips, to pipe and wire baskets and rock-faced slopes to heavy rock riprap toe walls. All these functioned during early stages of the run-off, and some held throughout, however, as storm followed storm, dikes were overtopped and finally pavement was undermined, culverts were carried away, while on other sections, debris was deposited on the highway to maximum depths of eight feet, for lengths as great as one-half mile.

Cache Creek, flowing out of Cameron Wash above Mojave, presented no unusual difficulties. Pine Tree Dip and Jawbone Canyon left such deposits that for several days it was necessary to carry traffic three feet above the pavement. Lesser deposits between Jawbone Canyon and Cantil were so extensive in length as to make their immediate removal impossible.

RED ROCK CANYON HIT

Red Rock Canyon, which has presented unusual difficulties to location, construction and maintenance since the horse and wagon days, exceeded all past records in destruction, tearing out approximately 50,000 yards of embankment and finally eroding to the solid rock, making the passage of traffic impossible. The upper dips in this notable scenic panorama filled completely with sand. Freeman Wash Bridge, a timber structure built in 1926, and the only bridge on the main highway within a distance of 120 miles, and already in a precarious condition, was overtopped and overburdened with a deposit of sand and gravel.

Indian Wells Canyon, above our Homestead Maintenance Station, added to its original high debris cone, flowed through our beautifully landscaped maintenance yard, cutting a new channel 30 feet deep and escaped across the highway, spreading out in the Indian Wells Valley, where the resulting silt bed disappeared into the sage, leaving a broad expanse of shimmering silt, resembling a vast sheet of ormolu. The silt deposit on the pavement in this area was so extensive that removal by shovel and bulldozer resulted in a canal section, and it will probably be weeks before traffic through this section will be enabled to view the beauty of the desert.



Top—Tractor at work removing deposit from roadway one mile northeast of Homestead, Route 23 in Kern County. Oil truck and trailer in background. Center—Bulldozer working to uncover roadbed on State Route 23 clearing three feet of silt from Pine Tree Dip Bottom—Entire roadway lost. Only portion of center line stripe remaining on this section of State Route 23

WIDE STORM DAMAGE

Sand Canyon, which also broke the aqueduct, spread over the highway for a quarter of a mile and water continues to drain and run from the immense deposit of saturated sands and gravel. The natural dip five miles south of Little Lake carried immense boulders and trees originating from beyond

(Continued on page 34)

CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

Mission San Juan Bautista
June 24, 1797

ON a spot called Popeloutchom by the Indians and San Benito by the Spaniards, the Superior of the Missions, Fr. Presidente Fermin Francisco de Lasuen, on June 24, 1797, founded Mission San Juan Bautista, dedicating it to the Glorious Precursor of Jesus Christ, Our Lord, Saint John, the Baptist.

The site selected was a place near the Rio San Benito, so named by Captain Pedro Fages when he camped there on March 21, 1772, with Fr. Juan Crespi, that infallible discoverer of mission locations.

Until February 12, 1874, Mission San Juan Bautista was in what now is Monterey County, but on that date Governor Booth signed the legislative bill creating San Benito County, which was carved out of Monterey, and the mission town became a part of the new subdivision.

Building operations at San Juan Bautista were launched immediately after the dedication ceremonies by Fr. Joseph Manuel de Martiarena and Fr. Pedro Adriano Martinez, the first resident missionaries. By the end of 1797, the padres reported the erection of a chapel, a dwelling for the priests, a granary, adobe habitations for Indian neophytes, a guardhouse and barracks for the soldiers and a building for unmarried Indian girls and women.

MARRIAGE CEREMONY

The apartment occupied by the native girls was called monjerio (nunnery) and the inmates on account of their segregation were considered monjas (nuns). Fr. Engelhardt, mission historian, says they were free to marry when an opportunity offered itself. When an Indian youth wanted a wife he would apply to the padre, who would ask him the name of his intended. The girl thereupon would be summoned by the priest and if she agreed preparations for the wedding in accordance with church regulations would be made. After their marriage, the couple would be assigned a house of their own and thereafter would enjoy the liberty and independence of full-fledged members of the Indian community.

Before the coming of the padres it was the custom for an Indian youth to select the girl he wished to marry and give presents to her father. Acceptance of these gifts sealed the marriage of the two without any other ceremony.

The San Juan Bautista Missionaries were industrious builders as their annual reports reveal. Some of their work was undone by an earthquake in October, 1800, but repairs were made and increased building activities undertaken. On June 13, 1803, the cornerstone of the new church was laid with impressive ceremonies. Fr. Martiarena retired to Mexico and was succeeded by Fr. Andres Dulanto in 1804.

MISSION BOASTED THREE NAVES

Fr. Dulanto in 1809 reported that "on June 3d the statue of Our Patron San Juan Bautista was placed on the main altar of the sacristy, which serves as a temporary church. The three naves of the temple of Mission San Juan Bautista were also completed this year."

Of all the California missions, San Juan Bautista was the only one that boasted three naves and was the widest of all mission churches. On June 23, 1812, the house of worship was completed after fifteen years of labor by the padres and their Indians and was blessed by Fr. Estevan Tapis, then Presidente of the Missions.

In 1815 and 1816 many Indians of the warlike Tulares who had been induced to come to the mission ran away and subsequently raided San Juan Bautista numerous times, murdering several neophytes. These periodical attacks upon the mission continued long after American occupation in 1847.

Following the Mexican revolt against Spain, 1810-11, the missions in California received no support from Mexico and the pay of the military in the territory having ceased for the same reason, the Franciscan missionaries and their Indian wards were compelled to provide the soldiers with food, clothing and money. San Juan Bautista contributed heavily.

CONVERTS INCREASE

However, Fr. Tapis and Fr. De la Cuesta continued to win converts at

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into northern Washington.

Present day State highways lead to all the mission sites. Now that the war is ended, California looks forward to again welcoming tourists from all over the world. With the resumption of normal automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways is publishing in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions are taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the eighth of the series.



Through peaceful and turbulent years padres have lived at Mission San Juan Bautista, administering to the religious needs of the community

San Juan Bautista and in December, 1821, reported they had baptized 359 Indians during the year. The following year they counted 267 converts. By 1823 the Indian population consisted of 641 male and 607 female neophytes and twenty-two additional adobe dwellings had to be built for the newcomers.

In October, 1825, Jose M. Echeandia, the first native Mexican governor of California, arrived at San Diego. He at once set in motion the political machinations that were to bring about the ruin of all the missions. Fr. Tapis, who had done so much to build up San Juan Bautista, died there on November 3d of that same year so that he did not live to see the wrecking of the Franciscan missionary stations.

One of Governor Echeandia's first acts was to issue a proclamation on January 1, 1826, requiring all missions, as a "New Year's gift," to pay ten per cent of their income for the benefit of the "well-deserving troops who conserve the peace of the territory." Thus began the impoverishment of the missions by the military.

LETTER OF PROTEST

In the summer of 1826, Fr. De la Cuesta, alone at San Juan Bautista with the care of 1,200 Indians upon his shoulders, wrote to Jose M. Herrera, Collector of Customs at Monterey:

"I see your application for supplies of all kinds in behalf of the troops. Some of the articles are not on hand. There are difficulties all around, and I am over-burdened with cares which render life wearisome. There is hardly any of the Religious in me, and I scarcely know what to do in these troublous times. I made the vows of a Friar Minor; instead, I must manage temporalities, sow grain, raise sheep, horses and cows. I must preach, baptize, bury the dead, visit the sick, direct the carts, haul stones, lime, etc. These are things incompatible, thorny, bitter, hard, unbearable. They rob me of time, tranquility, and health of both body and soul. I desire that lively anxiety to devote myself to my sacred ministry and to serve the Lord."

For many years there has been a tradition that Mission San Juan Bautista was founded with the aid of a barrel organ the music of which attracted the Indians to the station on the day of dedication in 1797. The story is that when the natives first heard the organ they fell down in fear then gradually gathered about the singing box with delight. It is a charming tale and it seems a pity it can not be sustained by old mission records. However, Fr. Engelhardt, mission historian, felt impelled to quote a report made by Fr. De la Cuesta at the end of 1829 in which the padre notes that the mission had been presented with a barrel organ that had been made in London. Fr. Englehardt believes the "music box" was donated to the Fathers at Monterey by some English skipper. One tune that the Indians liked was unknown to the padres. It was not until years later that its name was learned. It was "The Siren's Waltz."

Fr. De la Cuesta's last report was dated December 31, 1832. There were at the mission 529 male and 396 female Indians. The station owned 6,000

head of cattle, 6,004 sheep, 20 pigs, 12 mules and 296 horses.

MISSIONS TRICKED

In 1833 the College of San Fernando de Mexico turned over to the College of Guadalupe Zacatecas the 10 California missions from San Antonio de Padua to San Francisco Solano in what is now Sonoma County and the Mexican padre, Fr. Antonio Anzar, succeeded aged Fr. De la Cuesta at San Juan Bautista, the latter retiring to Mission San Miguel.

Youthful California politicos joined with Echeandia and Jose M. Padres in plans to confiscate the missions and on July 15, 1834, the then Governor Jose Figueroa issued his proclamation secularizing the missions. Historian H. H. Bancroft says that Figueroa tricked the missions as he knew that he and his legislature had no authority to issue such a decree without the sanction of the Mexican Government. Indeed, the action was repudiated by the Government of Mexico on November 7, 1835.

Nevertheless, Figueroa and the young Californians proceeded with their scheme and Mission San Juan Bautista became a curacy of the second class under a civil administrator.

SAN JUAN BAUTISTA RUINED

On May 9, 1835, Commissioners Antonio Buelna and Jose T. Castro filed an inventory taken at San Juan Bautista and placed a valuation of $138,723.37 upon the mission and its property. The Indians were proclaimed to be "free," they were given shares of land and some money and equipment and were expected to support themselves under the supervision of a paid Mayordomo.

However, the Indians were helpless to do for themselves and gradually began withdrawing to the country of the Tulares where they could, in truth, be free. Bancroft says that "while at the end of 1836 the mission estate had still about 900 cattle and 4,000 sheep, with a crop of 900 bushels, and a debt of $1,300, there were no traces of a community. Constant depredations by savages, aided by ex-neophytes, from 1837 on contributed to the work of ruin."

"Thus," says Fr. Engelhardt, "a flourishing Indian mission headed by an unsalaried missionary was, under secular management, ruined in less than two years."

TURBULENT TIMES

In place of the Indian mission village a little settlement of whites came into existence near the church of San Juan Bautista, which by the end of 1839 numbered some 50 inhabitants. The new pueblo became the town of San Juan Bautista, the history of which is one of romance, stirring pioneer days and much bloodshed. During the 50's there occurred a number of lynchings by a Vigilante's Committee and such famous bandits as Joaquin Murietta, "Three Fingered Jack," Vasquez and Chavez frequented there, the two latter committing many raids and a number of murders.

Through all these turbulent times, kindly padres lived at the Mission, as they do today, administering to the religious needs of the community.

In 1842, Governor Manuel Micheltorena returned to San Juan Bautista, as well as the other missions, to the Franciscans, but the act brought about his overthrow by Pio Pico and other enemies of the missions.

In September, 1845, Governor Pico appointed his brother, Andres, and Juan M. Manso as commissioners to make mission inventories preparatory to sale of the missionary stations at public auction. The two placed a valuation of $7,860 upon San Juan Bautista, its lands and other properties. In May of the next year, Pico began disposing of the mission lands.

AMERICAN PROTECTION

Following the raising of the American flag at Monterey, U. S. Army officers



Attractive spot in gardens of Mission San Juan Bautta

set about protecting the missions and establishing their rightful ownership. In March, 1847 General Stephen W. Kearny, American Military Governor, issued an order in which he said that "inasmuch as there are various claimants to the missions of San Jose, Santa Clara, Santa Cruz and San Juan Bautista, I do hereby decree that until the proper judicial tribunals shall decide upon the same the above-named missions and property appertaining thereto shall remain under the charge of the Catholic priests, as they were when the United States flag was raised in this territory."

On November 19, 1859, President James Buchanan returned San Juan Bautista Mission to the church. From the day of its founding, San Juan Bautista never lacked a spiritual guide or pastor.

Fr. Francisco Mora became resident missionary at the mission in June, 1856, and Fr. Engelhardt tells an interesting story handed down by the young priest. It seems that the Indians who composed the choir at San Juan Bautista found they could not keep sober on Saturday nights, due to the widespread distribution of the white man's whiskey and consequently were in no condition to sing at High Mass on Sunday. So one Saturday they went to the priest and inquired: "Pare, do you want to have a High Mass tomorrow?" To which Fr. Mora replied: "To be sure, Amigos. Why do you ask?" The leader replied "Padre, if you want a High Mass tomorrow you will have to lock us up for we can not keep sober."

SISTERS ARRIVE

The astonished padre agreed, told them to get their suppers and return to the guardhouse with their blankets. He locked them up for the night. This practice was followed with the consent and approval of the Indian choir singers for years.

Fr. Antonio Anzar, who succeeded Fr. Mora, in 1858 induced some Sisters of Charity of Emmitsburg, Maryland, to establish an orphanage and day school at the mission. In 1871, the Sisters and orphans moved to the orphanage at Santa Cruz. In the same year, six Sisters of the Immaculate Heart of Mary, newly arrived from Spain, arrived at San Juan Bautista, two school buildings were erected for them and they conducted a school for orphaned girls until 1906. The earthquake of that year did considerable damage to the church and orphanage.

The first of a number of fiestas to raise funds for restoration of the mission was held at San Juan Bautista on June 24, 1907, to commemorate the 110th anniversary of its founding. A huge cross was raised on Mount Holy Cross, two miles from the mission, and blessed. June 19-20, 1936, a similar celebration in honor of the 139th anniversary of San Juan Bautista was held.

In August, 1928, the mission was placed in the hands of the Maryknoll Fathers whose resident missionaries have done much to restore and maintain this old Franciscan station.

San Juan Bautista, 16 miles north of Salinas, and formerly on the old Coast Highway, El Camino Real, U. S. 101, now is about two and a half miles off the realigned Coast Highway and is reached over an excellent connecting road built by the State Highway Commission at the solicitation of Father Caffrey of the mission. Elimination of San Juan grade by construction of the Prunedale cut-off took the mission off the main traveled route, but the new connecting road makes it easy for motorists from northern or southern points to turn off for the short run to San Juan Bautista.

Visitors coming from the San Joaquin Valley will turn west at either Chowchilla or Califa and proceed through Los Banos a distance of 78 miles over State Route 124 to its intersection with State Route 22, thence south 8 miles to Hollister and west 8 miles to San Juan Bautista.

Mission San Carlos Borromeo
June 3, 1770

DISCOVERED in 1542 by Don Juan Rodiguez Cabrillo, bold Portuguese navigator in the employ of Spain, ignored by the Spanish crown until 1602, when General Sebastian Vizcaino landed there and wrote glowing accounts of its ideal harbor and back country, and again forgotten by Spain for a period of 168 years, Monterey was destined to be the scene of Father Junipero Serra's greatest missionary efforts and his last resting place.

Fearful that the Russians, who were moving down the North Pacific coast, intended to seize all of what now is California, a new country Spain claimed as a result of the voyages of Cabrillo and Vizcaino, the Spanish Government in 1768 directed Inspector General Joseph de Galvez to send expeditions from Mexico to Upper California to lay claim to the territory and "plant the standard of the holy Cross among the heathens."

We have seen in the story of the founding of the first Franciscan mission at San Diego how Fr. Serra accompanied the forces of Gaspar de Portola from La Paz to San Diego and how he went with the second Portola expedition north in search of Monterey Bay, Portola going by land and Junipero by sea. Portola's first quest had failed, he and his men not recognizing Monterey Bay from the hills surrounding it. However, the second expedition was a success and Portola and Fr. Serra both arrived at Monterey in May, 1770.

PORTOLA LEAVES MESSAGE

It was on his weary march back to San Diego that Portola pitched his camp on a hill overlooking Carmelo Bay near a spot where Mission San Carlos later was established. Here Portola caused a cross to be erected on which was carved: "Dig at the base and thou wilt find writing." A bottle containing an account of the failure to discover Monterey Bay, of the finding of San Francisco Bay and of the necessity of returning to San Diego to escape starvation was buried at the foot of the cross.

On his return expedition, Portola again camped at Carmelo there to await the arrival of Fr. Serra and the sea party in the San Antonio. The two forces were joined on June 1, 1770, and orders were given to remove the camp from the arroyo near the Rio Carmelo to the harbor of Monterey. Portola fixed June 3rd as the day upon which formal possession would be taken of Monterey Bay and its lands in the name of King Carlos III of Spain.

SPAIN CLAIMS MONTEREY

Describing the ceremonies attending the raising of the Spanish flag on what was to be the presidio of Monterey, Fr. Crespi wrote:

"On the same day, June 3rd, Pentecost Sunday, 1770, on which Governor and Commander Gaspar de Portola took possession of the Port of Monterey in the name of the king, and began the presidio of San Carlos, the Rev. Fr. Presidente of all the Missions, Fr. Junipero Serra, in the name of the king, and in the name of the Rev.



Here at Mission San Carlos Borromeo are the tombs of Fr. Junipero Serra, Fr. Crespi, Fr. Lasuen, and Fr. Julian Lopez

Guardian and of the Ven. Discretory of the Apostolic College of the Propagation of the Faith of San Fernando de Mexico, began the new Mission under the title of San Carlos, naming as chief patron of the new church the most holy Patriarch St. Joseph, as he had been directed by the illustrious Inspector-General that two patrons should be assigned, one for the Mission, who was San Carlos Borromeo, and the other for the church, who was the most holy Patriarch St. Joseph. As our ecclesiastical head, he (Fr. Serra) took possession of it in the name of the said College, appointing as his companion missionary Fr. Juan Crespi, his pupil in philosophy, which he had taught him in the royal monastery of our Seraphic Father San Francisco in the City of Palma in the holy Province of Majorca."

An arbor of boughs served as the first church of the new mission and in it was a table for an altar on which holy Mass was celebrated until a temporary chapel was built.

SERRA SOUGHT NEW SITE

As early as July, 1770, two warehouses had been erected and several smaller, primative buildings put up. But it would seem that almost from the start, Fr. Serra felt that the site chosen was not a good one because of its proximity to the presidio and its soldiers and because of a dearth of Indians in that locality. Wherefore, when the San Antonio sailed for Mexico it carried a petition from Junipero to the Viceroy requesting permission to move the mission to the Rio Carmelo across the peninsula o Point Pinos.

Fr. Palou reported at the end o 1770: "On December 26th the firs baptism took place in the pagan nation It was for the fervent and ardent hear of our venerable Father Serra a indescribable jubilee."

On May 21, 1771, 10 Franciscan Fathers from the missionary Colleg of San Fernando in the City of Mexico who had volunteered for service with the California missions, arrived a Monterey, bringing joy to Fr. Serra even then dreaming of the great chain of Franciscan stations that was t

(Continued on page 32)

California Highway Problem Is of First Priority, Governor Says

URGED by Governor Warren to make as much speed as will be consistent with a thorough study of California's highway problems, the Joint Fact-Finding Committee on Highways, Streets and Bridges, created by the Legislature, is holding meetings in many sections of the State in order to obtain first-hand information on the highway needs of California.

Hearings have been held in many of the larger cities, in scores of communities from one end of the State to the other, and last month the committee, under the chairmanship of Senator Randolph Collier of Yreka, completed a five-day tour through the counties of the Redwood Empire.

At a meeting in the State Capitol in Sacramento, the committee was addressed by Governor Warren, who told the members that in his opinion the highway problem is one of first priority.

"I think that we have immediate need for an overall highway program," the Governor said. "We do not have such at the present time and haven't had for some years. There was a time about 15 or 20 years ago when California was the envy of the country so far as highways were concerned, but at that time we had probably one-third as many people as we have now.

"As a State, we have entirely outgrown our highway system. Our big cities have absolute bottlenecks in them that can not be cured other than by drastic action. We need freeways in those communities so that they can fill the city up in the morning and empty it at night quickly. We need farm-to-market roads; need them very badly.

"Our country roads are run down in many, many respects. We need highways up into the recreational areas so that we can develop the greatest industry that we have had in the past, our tourist industry. We need every kind of highway conceivable. Now, the questions confronting us are: Where are we going to put them? According to what plan? And how are we going to pay for them? That means study, and we have not had a real highway study for many years.

"I think it is a fine thing that the Legislature has set up this committee. There is only one thing I would urge upon you and that is to make speed, because time is the essence.

"I believe, gentlemen, that the time has come when we have to meet this question head on, not only as to what we are going to do, but as to how we are going to finance it. People in the back counties can not pay for farm-to-market roads. Naturally they can not open up the roads into the recreational areas; it is too expensive. Our

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Members of Joint Fact-Finding Committee on Highways, Streets and Bridges in session. Left to right: Assemblyman Gerald P. Haggerty, San Francisco; Senator Jerrold L. Seawell, Roseville; Senator Randolph Collier, Yreka, Chairman; Assemblyman Charles W. Stream, Chula Vista, Vice Chairman

CALIFORNIA MISSIONS

(Continued from page 30)

stretch from San Diego to San Francisco and on north to Sonoma.

Fr. Serra assigned the newcomers to their fields and sent them to San Diego aboard the San Antonio, only Fr. Juan Crespi and himself remaining at Monterey. He, himself, with a handful of soldiers then set out to locate a suitable new site for Mission San Carlos. He found one to his liking, ordered the felling of trees for lumber and then traveled south into the Sierra de Santa Lucia, where on July 14, 1771, as we have seen, he founded Mission San Antonia de Padua.

MISSION WAS SERRA'S OWN

Desirous of himself founding Carmelo Mission, Fr. Serra lived in a little shack on the site, leading the life of a hermit. Fr. Palou records that the Indians came to love Junipero, whom they called the Old Father. At the end of 1771, Fr. Serra with Fr. Crespi and two Indian neophytes moved to Carmelo which, Fr. Palou says, "became his (Junipero's) own peculiar mission, where he continued till his death, when he was not bound to visit other missions or make necessary journeys in virtue of his office of Presidente of the Missions."

We know of the famine that struck San Carlos and other missions due to delay in the arrival of foodships from Mexico, of Captain Fages expedition into the Valley of Bears, where Mission San Luis Obispo was to be established, of the thousands of pounds of bear meat he sent back to Monterey, of Fr. Serra's journey south with him to San Diego and of Junipero's trip to Mexico in 1773 to confer with the viceroy on plans for future missions. Fr. Serra returned to San Carlos in May, 1774.

Fr. Palou records that for eight months in 1774 "milk was the manna for all from the commandante and the Fathers down to the least individual. * * * At this Mission of San Carlos for thirty-seven days we were without a tortilla or as much as a crumb of bread. The meals consisted of a gruel made of garvanzos or beans ground to flour with which milk was mixed."

On June 27, 1775, the San Carlos dropped anchor in Monterey Bay bringing a letter from the viceroy to Fr. Serra explaining that it was desired that the country around San Francisco Bay be examined for sites for a presidio and mission. Fr. Palou and Fr. Campa were sent north with an expedition to choose a site for Mission San Francisco.

GOVERNOR DE NEVE'S ENMITY

Felip de Neve arrived at Monterey in February, 1777, with the title of Governor of California. Two years later, without consulting Fr. Serra he ordered that the Indian neophytes at every mission should elect from among them an alcade or magistrate and two regidores or councilors, and be instructed in self-government. From Carmelo the Fr. Presidente waged his long fight against this move, foreseeing exactly which came to pass; which was that the Indians, but recently ignorant savages, would not know how to use and would abuse the authority given to them.

Fr. Engelhardt, Mission historian, says that "at Mission San Carlos, Fr. Serra's own mission, and in the very neighborhood of Neve's headquarters, the experiment proved especially disastrous." He then goes on to tell how one Baltasar, elected alcade, drunk with authority, broke all the laws of the church and the civil government. The same situations were developing at the other missions.

Governor Neve evidently was determined to affront Fr. Serra in every possible way and ordered him to cease administering the Sacrament of Confirmation, basing his action on the inability of Junipero to produce the Bull of the Pope, document of his right to confirm. Fr. Serra refrained from visiting any of the missions for a year because he knew the Indians would wonder why he did not confirm. Finally Viceroy Mayorga notified Neve that Fr. Serra was duly authorized to confirm. The incident added to Neve's dislike of the missionaries.

SERRA MAKES FAREWELL TOUR

Worn out by his long fight to protect his missions, Fr. Serra felt that his end was near and, aged and poor in health, he made a farewell tour of the Franciscan stations in 1783. Back in Monterey in July, 1784, he sent for Fr. Palou, who was in San Francisco. The latter hastened at once to San Carlos.

Of the last illness and death of Fr. Serra, his faithful biographer, Fr. Palou, left a touching account. Fr. Serra died a little before two o'clock the afternoon of August 28, 1784, at the age of seventy years and nine months, after fifty-four years devoted to his church.

Fr. Palou became temporary presidente of the missions and took up his residence at San Carlos. He served until September, 1785, when he retired to Mexico and was succeeded by Fr. Fermin Francisco de Lasuen. Fr. Palou wrote four volumes, Noticias de la California, and his history of Fr. Serra and the Franciscan missions is a notable contribution to literature and to California history.

It is not necessary to follow the fate of San Carlos through the years of its decay under Mexican civil government rule. It is tragically similar to that of the other California missions. It is recorded that the first stone of the new church was laid on July 7, 1793. There followed the years of Governor Echeandia and his successors, the dispersion of the Indians at San Carlos, the sufferings of the neophytes and the padres and final confiscation of San Carlos by Governor Pio Pico in 1845. Fr. Engelhardt says that poor Mission San Carlos had been so bled that there was nothing to auction off so that "Father Serra's Mission did not suffer the disgrace of having to come under the hammer" as did the other missions.

MISSION RETURNED TO CHURCH

San Carlos was returned to the Catholic church by President James Buchanan on October 19, 1859.

In 1852 the tiled roof fell in, the walls collapsed and grass and weeds covered the floor of the old mission church. It was in ruins in 1868 when Fr. Angelo D. Cassanova was appointed to the parish of Monterey. He at once set about having the debris cleared and planned for the restoration of the mission. On July 3, 1882, with about 400 persons present, Fr. Cassanova had the tombs of Fr. Serra, Fr. Crespi, Fr. Lasuen and Fr. Julia Lopez opened to determine if the Father of the California Missions and his brother padres really slept there in the mission church as ancient records indicated.

The priests were there in redwood coffins and all the coffins except that of Fr. Lasuen were excellently preserved.

In October, 1924, Monterey held a fiesta in honor of Fr. Serra the pri

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Bridge Maintenance Practice On California Highway System

(Continued from page 16)

RIO HONDO BRIDGE

A somewhat similar accident occurred at the bridge across the Rio Hondo on Anaheim-Telegraph Road, State Route 166, in Los Angeles County. A truck and semi-trailer loaded with bulk oranges and towing a trailer also loaded with bulk oranges, was proceeding across the structure when the trailer broke loose and struck the southeasterly end of the upstream truss in Span 4. This knocked out the endpost and resulted in failure of the truss, as shown in **Photograph 6**. Repairs similar to those described for the West Fork of the San Gabriel River were made; however, in this case, the lower chords were built of steel. The damaged piece was cut off, straightened and reinstalled by making a welded splice.

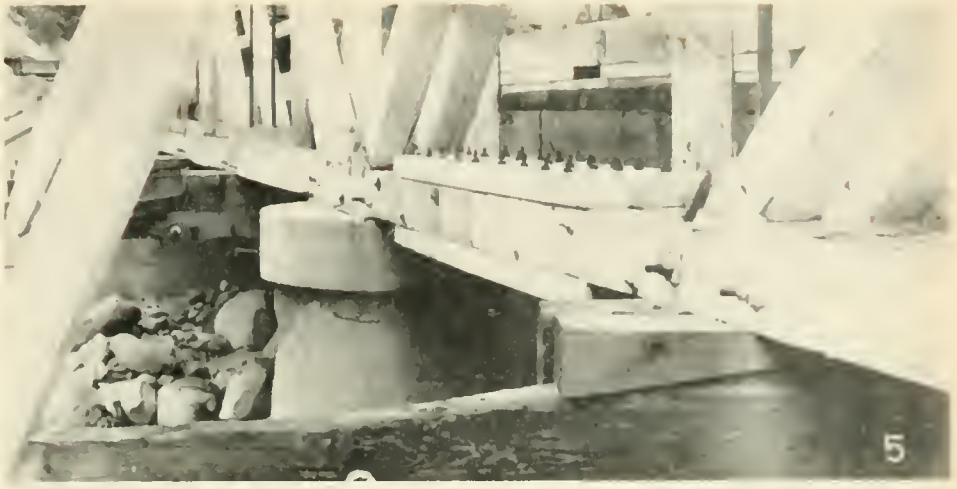
SAN FELIPE CREEK BRIDGE

The bridge across San Felipe Creek on State Route 198 between Julian and Kane Springs, was struck by a trailer which damaged an intermediate post (U2-L2). The post was knocked out of its lower seat and the joint was raised about 6 inches due to absence of the compressive force normally furnished by such post, but the truss did not collapse, due probably to the vertical shear resistance offered by the top chords. The structure was underpinned as shown on **Photograph No. 7**, the damaged post was replaced with a sound timber and the bridge was returned to service, at nominal cost, in a reasonably short time.

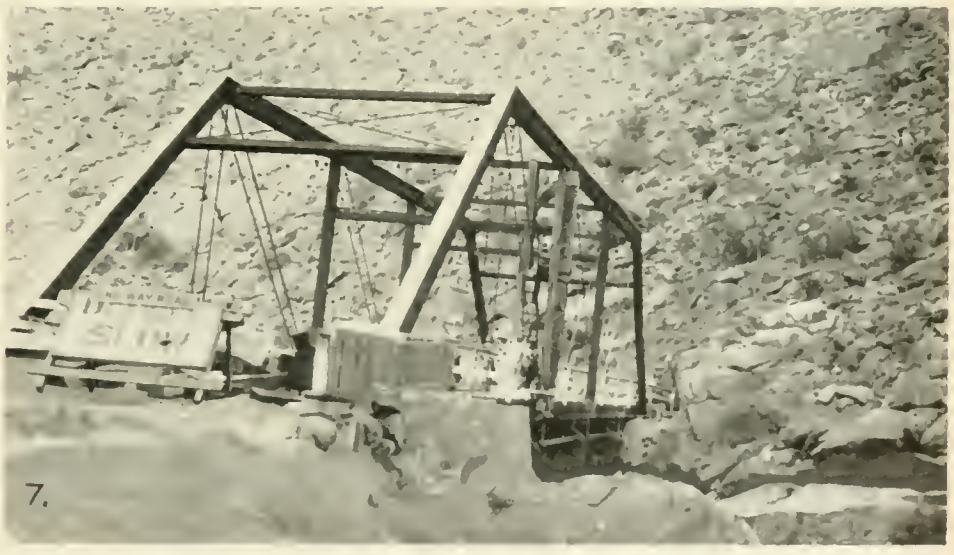
Continued use of these old, light and outmoded bridges demands constant vigilance and ingenuity in keeping them safely in service until a program of reconstruction will permit their replacement.

Due to progressive deterioration and general loss of strength of some materials with time, it is generally expedient to make critical periodic reviews of all stress analyses in order to maintain a load rating which will be consistent with the known capacity and physical condition of the truss members and materials. It is only through close periodic field inspection that such conditions can be properly determined and corrected and an engineering organization equipped to do just such work is mandatory is proper checks along this line are to be realized.

This article has covered only some of the more usual kinds of trouble which are generally encountered in such timber truss bridges and has indicated several methods which have successfully been employed in handling problems of this nature.


5


6


7.

One morning some university students brought a donkey into the lecture room.

"Take your seats, gentlemen," said the professor. "I see there's one more of you this morning."

Record Storm Hits District IX

(Continued from page 25)

sight of the highway and blocked traffic during each violent downpour. During the last storm 623 cars were counted as awaiting the ebbing of this torrent. The storm damage extended for 50 miles north of this point, but traffic delays and total obliterations of the highway were only sporadic and not too unexpected as to locality.

It was necessary to detour traffic 40 miles easterly from Mojave to Cramer Junction and northerly through the old mining town of Johannesburg from Sunday noon until Wednesday morning. Some venturesome and more impatient wayfarers traversed the tortuous route through Trona to Wild Rose or Darwin before the shorter paved detour through Inyokern could be adequately cleared and signed. The hill above Inyokern remained impassable and necessitated detouring via Inyokern until the following Saturday evening. Numerous short sections were so narrowed as to permit only one lane traffic for as long as three weeks.

LIGHTNING CAUSES HAVOC

The storm struck over a weekend during vacation, deer and trout season, and was concentrated in the superintendent's section where, due to manpower shortage, only 11 employees below the grade of foreman, were on the payroll. Telephone lines were repeatedly struck by lightning, thus presenting a startling display of burning and exploding poles, but more prosaically interfering with calls for additional help. However, as fast as word of the debacle could be spread throughout the district, employees from top to bottom, almost without exception, responded enthusiastically and persistently to rush equipment, labor and supplies to the scene of disaster.

Inyokern naval authorities supplied and manned more and larger road-building equipment than the district could supply. The Marines from the Mojave Base transported State equipment and continued to furnish a much needed guard detail.

All of these resulted in abetting the resumption of traffic on our main line as expeditiously as was possible, although the restoration of pavement, roadbed and roadsides to their former condition and the construction of more adequate protection will undoubtedly necessitate several months.

C. H. Purcell is Again Honored By Profession

RECIPIENT in 1944 of the highly prized George S. Bartlett award for outstanding contributions to highway progress, C. H. Purcell, Director of Public Works, has had another high honor conferred upon him by the American Society of Civil Engineers in recognition of his outstanding professional accomplishments by election as honorary member of the society.

The award of honorary member will be made to Mr. Purcell at the Society's annual meeting January 14th and 15th in New York.

Mr. Purcell has been a member of the society since 1916 and has been affiliated with the Sacramento section since 1928.

Prior to coming to Sacramento he was District Engineer for the Public Roads Administration in Portland, Oregon. The district included the States of Oregon, Washington, Idaho, Montana and the Territory of Alaska.

Mr. Purcell came to California as State Highway Engineer in 1928. After 15 years of service as State Highway Engineer he became Director of Public Works on January 5, 1943.

In addition to his many duties as State Highway Engineer, he became chief engineer in 1933 of the $75,000,000 San Francisco-Oakland Bay Bridge. In 1941 the President of the United States appointed him a member of the Interregional Highway Committee.

Mr. Purcell served as president of the American Association of State Highway Officials in 1938. He holds honorary degrees of Doctor of Laws from the University of California and Doctor of Engineering from the University of Nebraska.

A lawyer asked a prospective juror:

"Who influences you the most—the witnesses, the judge or the lawyers?"

And the prospect replied.

"I ain't influenced by anything said by the witnesses, the judge or the lawyers. I just look at the prisoner and say to myself: 'If he ain't done anything wrong, why is he here?' and I vote 'em all guilty."

California Highway Problem Is of First Priority, Governor Says

(Continued from page 31)

cities can not pay entirely for freeways; the State has got to step in and do something about it. The question is: How are we going to finance such programs? We can not finance them from the General Fund. There just isn't enough money coming in. We can not finance them from the present funds that are coming into the Highway Department; everybody knows that.

"So, the thing we have to do is find a way to finance the programs and then go about financing them. I think this can be done. I think the people of the State in every walk of life are sufficiently interested in getting highways to reconcile their differences and agree upon a way of financing. This is the first step and the principal obstacle. If we can get over that hurdle we can solve the other problems, and I know that you gentlemen with the facilities that are available to you in the State, and with the appropriation you have, can do it in a comparatively short time. I urge you above all things to make as much speed as is possible under the circumstances."

Water Problem in Expert Hands

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points of those who are interested in the use of water and its by-products, and also the thinking of those who have vision for the future of our State and its ultimate development through the utilization of water.

"I know of no better way to get a bird's-eye view of thinking in regard to water resources in California than to invite all who are concerned to come to the capital of our State and express themselves on the subject, and endeavor to reconcile their views with those who may be seeking the same ultimate objective but who, because of their own special problems, may differ in approach.

WATER CONFERENCE

"I believe we should have a water conference at Sacramento at the

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California State Highway System, Its Needs, Problems, and Outlook

(Continued from page 2)

axle load of loaded trucks jumped from 6,600 pounds in 1936 to 12,000 pounds in 1944, an 81.1 per cent increase.

The improvements in construction standards, namely: wider lanes; multiple lanes; divided highways; thicker pavements; heavier bases to carry the increased pavements and loads; improved alignment and grades, with more sight distance at both horizontal and vertical curves; together with the decided rise in cost of materials and labor have all materially increased highway construction costs.

COST OF CONSTRUCTION UP

In years gone by, State highway construction was almost entirely limited to rural locations. Now a very large portion is located in urban areas, much of it through congested portions of cities. These changes in locale also have greatly increased costs of construction, particularly in the phase of right of way acquisition, and, in freeway development, the added expense of structures necessary for elimination of cross traffic.

Twenty-five years ago an acceptable highway following the general contour of the countryside could be graded and surfaced at a cost of $30,000 per mile. Fifteen years ago, excellent two-lane highways built to vastly improved line and grade, were placed at construction costs of $60,000 a mile. Simple four-lane divided highways coming into use seven or eight years ago ran the costs up to $100,000 per mile and more. Today, freeway construction through congested metropolitan areas, with high right of way costs, multiple lanes and complicated structures, may run a million dollars or more per mile.

MEETING PROBLEMS

The problems of State highway administration do not diminish as the years and demands of traffic progress.

Undoubtedly there has arisen in your minds the question of what is the State of California doing to meet these multiplied problems of motor transport.

Three years ago, when it became apparent that highway construction operations would be drastically curtailed during the war and that the Division of Highways program of progressive State highway development would be suspended during the emergency, plans were laid for the resumption of State highway development at the earliest possible time. Funds on hand and revenues anticipated from existing sources were appraised and it was determined that with the money in sight at that time a postwar highway construction program totaling $80,000,000 could be undertaken. Such a program was selected and approved by the California Highway Commission. It comprised projects which had been budgeted but which were deferred because of the war; of projects which had been programmed and for which plans and specifications were well advanced; of projects which were indicated as essential for traffic; and of critical bridges.

POSTWAR APPROPRIATION

As of vital assistance in formulating this program, the 1943 Legislature, at the instance of Governor Warren, appropriated a sum of $12,000,000 for preparation of plans and specifications and for the acquisition of rights of way.

During the war, personnel of the Division of Highways was drained by military leaves and losses to war industry, particularly from the younger men on the engineering staff. At the same time, even though Federal restrictions practically limited State highway activity to maintenance and repair, the Division of Highways at the request of the Public Roads Administration, the Army and the Navy undertook the planning and construction of access road projects to military, naval and industrial establishments totaling $30,000,000 and for the U. S. Air Force construction of flight strips amounting to more than $2,000,000.

This was an undertaking which nearly equaled normal prewar State highway construction programs. However, so that preparation of the postwar program would not lag, all members of the organization not required for State highway and access road projects were assigned to survey parties and drafting tables in the preparation of postwar plans, specifications and estimates and to work in connection with the acquisition of right of way.

CONGRESSIONAL ACTION

Preparation of the program progressed and with time it became apparent that the revenue which would be available was not static but progressive. Congress considered, debated and passed in 1944 a $1,500,000,000 Postwar Federal Aid Program—$500,000,000 for each of three postwar years, which to California means yearly apportionments of $17,000,000 for rural and urban Federal aid routes and $5,000,000 for Federal aid secondary or feeder roads. Wartime revenues from the gasoline tax did not drop quite as low as had been expected and the "come back" since V-E and V-J days has been rapid.

The net result from this fluid condition of expected available revenues makes it now appear that from all sources of State highway revenue: gasoline tax, motor vehicle registration, regular Federal aid and urban Federal aid will be provided a total of about $145,000,000 for construction during this and the next three fiscal years.

As stated, the condition is fluid. In preparing this latest estimate of $145,000,000, the July and October apportionments of gas tax revenue were given projected consideration. The full effect of the end of gasoline rationing, however, was not completely manifest in the October apportionment, but it is expected that the January, 1946, apportionment will provide a firmer base for projected estimates of revenue.

GAS TAX COLLECTIONS CONFUSE

In this connection, may I call attention to the fact that newspaper releases on receipts from gas tax collections may be misinterpreted, as the figures given are usually the total collections and by the time the State Controller actually apportions the funds to the Division of Highways, the counties and the cities, a shrinkage of some 10 per cent in refunds and collection expense normally occurs.

This Postwar State Highway Program for the coming four years will not, of course, completely solve the transportation problems on the system, but the $145,000,000 will make more than an appreciable start in correction of those critical deficiencies which it is estimated will require $695,000,000 in construction and reconstruction.

The California Highway Commission has adopted a flexible program

which may be expanded by addition of critical projects as additional funds become available. For the first postwar year, the commission approved an initial partial program totaling $40,000,000 in construction cost.

POSTWAR PROGRAM PROGRESSES

Progress on this program is well advanced. On September 28th, Congress passed its concurrent resolution authorizing the Public Roads Administration to enter into agreements with the State for postwar construction and on October 29th the Public Roads Administration approved California's Federal Aid Program and portions of the Federal Aid Urban Program. Immediately thereafter, the Division of Highways, on November 9th, published the first call for bids on construction of postwar projects. During the past three weeks advertisements have been published by the State Highway Engineer for 23 projects totaling estimated costs of approximately $11,000,000. Bids on the first of these were opened in Sacramento November 28th and others are being opened here in Los Angeles today.

It is planned to continue placing the postwar State highway projects under construction at a projected rate of approximately $2,000,000 per week until the entire initial program is in the hands of the construction industry. For the second and third postwar years, advertising for bids will keep pace with each year's $17,000,000 Federal aid apportionment as it becomes available on July 1, 1946, and July 1, 1947.

FREEWAY DEVELOPMENT

Included in the initial $40,000,000 program is development of the Bay Shore and East Shore Freeways in the San Francisco Bay area; the Hollywood and Santa Ana Freeways in Los Angeles, the Balboa Freeway in San Diego; portion of the four-lane divided arterial between Sacramento and San Francisco; sections of main highway construction in the San Joaquin and Sacramento Valleys; parts of the coastal arterials north of San Francisco, between Los Angeles and San Francisco and between Los Angeles and San Diego; as well as work on other inland arteries. In addition will be included replacement of many bridges throughout the system.

Besides the State Highway Program, the early postwar years will see the well-rounded $25,000,000 program of county road improvement financed with the $15,000,000 in Federal funds apportioned to California for Federal Aid Secondary roads and the $12,000,000 appropriated by the last Legislature for the use of the counties in matching the Federal aid secondary funds. The State enactment providing these matching dollars stipulated that 87½ per cent of the Federal apportionment be used for improvement to county roads.

In closing, may I emphasize the inadequacies of the State highway system today and the fact that with a wartime increase in population of 2,000,000 and further large increases expected from returning men who will want to settle in California, the motor transport problems of the State will multiply as never before.

If California highways are to function in furnishing adequate service to present and future traffic immediate provision must be made for financing a program of $695,000,000 for the correction of critical deficiencies on the State Highway System.

CALIFORNIA MISSIONS

(Continued from page 32)

cipal event of which was the unveiling of the Serra sarcophagus at Carmel on Sunday, October 12th. The sarcophagus stands in the adobe chapel to the left of the entrance of the church, which, largely through the efforts of Fr. Raymond Mestres has been restored and made a fitting place for the tomb of Fr. Serra. It is a panel work depicting the history of California and presents Fr. Serra, Fr. Crespi, Fr. Lasuen and Fr. Lopez. It is by the artist, J. J. Mora.

Mission Trail motorists coming either from the south or north will leave U. S. 101, El Camino Real, at Salinas and turn west over State Route 117 to Del Monte and Monterey, 18 miles, thence southwest 4 miles to Carmel. Or coming from the north to Santa Cruz the route is over No. 56 to Watsonville, Castroville and Monterey to Carmel.

Mission visitors from the San Joaquin Valley will turn west at either Chowchilla or Califa and follow Route 32 west to Gilroy, thence to Watsonville and south over Route 56 to Monterey and Carmel.

Next—Mission Santa Cruz and Mission Santa Clara.

Water Problem in Expert Hands

(Continued from page 34)

earliest convenient date in order that all of us who are charged with responsibility in this field will have the views of those directly affected by our findings and policies.

"In making my appointments to this board I can assure you I kept in mind what I sincerely believed was the intent of the Legislature, that men possessed of special training and experience be selected. I believe that each of you brings to this board understanding and ability which will enable you to render your State exceptional service. Big as the problem before you may seem, it is not too big for men to solve in a State which is willing to seek the solution. All of us have confidence in our State and I know that through your service on this board you will both add to, and speed, the fulfillment of the visions for the future which all of us hold."

Richard S. Badger Retires After 31 Years of Service

Bringing to a close 31 years of service with the Division of Highways, the last 15 of which he was Construction Engineer for District VI, Richard S. (Dick) Badger retired on October 31st, last.

Mr. Badger was born October 21 1882, at White Sulphur Springs, Montana. He received his B.S. in Civil Engineering at University of California, Berkeley in 1906.

In February, 1912, he joined the Division of Highways under J. B. Woodson, first Division Engineer in District VI.

In 1913 he started with the first construction operations in Merced County as Assistant to Resident Engineer Dan Chamberlin, later to become Assistant Division Engineer. He met and married Miss Jean Hohenshell, in July, 1916.

Later Mr. Badger worked at headquarters in the Maintenance Engineer's office, then to District V for early preliminary surveys on the Prunedale Cut-off.

State of California

EARL WARREN, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

CHARLES H. PURCELL, Director of Public Works

A. H. HENDERSON, Assistant Director

HIGHWAY COMMISSION

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CALIFORNIA STATE HIGHWAY SYSTEM



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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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C. H. PURCELL, Director GEORGE T. McCOY, State Highway Engineer K. C. ADAMS, Edito

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Postwar Highway Projects Advertised at the Rate of Nearly $2,000,000 a Week

By GEO. T. McCOY, State Highway Engineer

SINCE the close of hostilities of World War II, the engineering staff of the California Division of Highways has been carrying forward to the contracting stage the preliminary work accomplished during the war years in making surveys; in preparing plans, specifications, and estimates; and in acquiring rights of way for construction projects to be undertaken in the postwar period. This preliminary work for the postwar State highway program was conducted simultaneously with the prosecution and completion for the Federal Government of Federal Access Road and Flight Strip programs totaling more than $32,000,000 in construction costs.

The California postwar State highway construction program totals $115,000,000. This amount includes projects which are planned for advertising, bid opening, and contract award during the first three postwar years. Construction of these projects is to be financed from accumulated and anticipated revenue of the State gas tax and motor vehicle fees and from apportionments to California of Federal funds authorized under the Federal Aid Highway Act of 1944.

The initial program for the first postwar year amounts to $40,000,000.

V-J Day was August 14, 1945, and on October 29th the Public Roads Administration approved California's Federal Aid program and portions of the Federal Aid Urban Program. Immediately thereafter, on November 9th, the Division of Highways published the first call for bids on construction of postwar projects. Between that date and January 31, 1946, advertisements for bids have been published at a rate of nearly two million dollars a week. Advertisements during these 12 weeks have included 48 State highway projects, totaling estimated construction costs of $20,529,600.

Bids on the first seven of the postwar projects were opened on November 28th and 29th. By the end of January bids had been opened on 42 of the 48 projects and the total of low bids received amounted to $19,872,100 as compared with the $19,648,900 total of engineers' estimates.

The net overrun amounted to $223,200 which is 1.14 per cent of the total engineers' estimates. Twenty of the 42 low bids were under the department's estimates and 22 were over. The percentage of savings on the 20 bids under the estimates ranged from 0.53 per cent to 25.65 per cent, six being greater than 10 per cent under.

By January 31st, 37 contracts, involving $19,098,000 had been awarded; bids were rejected on three projects; and 2 projects involving $353,300 were pending award.

If satisfactory bids continue to be received it is planned to place State highway projects under construction at a rate of approximately $2,000,000 per week until the entire $40,000,000 initial program is in the hands of the construction industry.

During the second and third postwar years, it is planned that advertising for bids and award of State highway construction contracts will keep pace with each year's Federal aid apportionments as they become available on July 1, 1946 and 1947. California's regular Federal aid and urban Federal aid apportionments amount to approximately $17,000,000 each year, which with State matching funds insure yearly State highway construction programs of at least $34,000,000.

In addition to the State Highway Program in California, the early postwar years will see a well rounded $25,000,000 program of county road improvement financed from the $15,000,000 in Federal funds apportioned to California for Federal aid secondary roads during the first three postwar years and the $12,000,000 appropriated by the 1945 session of the State Legislature for the use of the counties in matching the Federal aid secondary funds. The State enactment providing these matching dollars stipulated that 87½ per cent of the Federal aid secondary apportionment be used for improvement to county roads.

In accordance with rulings of the Public Roads Administration the Division of Highways is administering these funds. The County Highway Aid Act requires the counties to submit programs for desired county road improvement to the Division of Highways within six months after September 15, 1945. Of the 58 counties in California, 33 have submitted programs and of these 33, 18 county programs have been formally recommended to the Public Roads Adminis-

(Continued on page 20)

Harrison R. Baker Is Reappointed to State Highway Body

REAPPOINTMENT by Governor Earl Warren of Harrison R. Baker of Pasadena to be a member of the California Highway Commission was confirmed by the Senate of the State Legislature on January 18. Originally named to the post on September 14, 1943, Mr. Baker won a three-year term when the newly-appointed highway commissioners drew lots for staggered tenures of office.

For 17 years a member of the Pasadena Planning Commission, a past president of the Pasadena Realty Board, president of the Davis-Baker Company and the Davis-Baker Insurance Agency and one of four men credited with promoting the famous Arroyo Seco Parkway between Los Angeles and Pasadena, Mr. Baker for many years has been an ardent booster for good roads. During the last three years he has devoted much of his time to State highway matters.

NEW DEVICES AID IN MAINTENANCE WORK

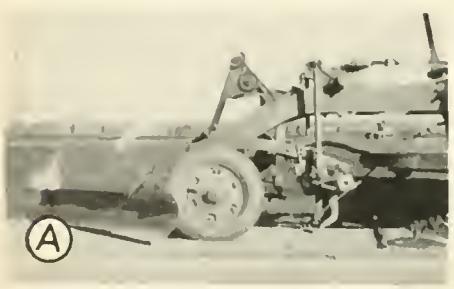
By CARL F. LIND, Assistant Highway Engineer

ALTHOUGH maintenance work was severely curtailed during the war, both by lack of material and scarcity of labor, this fact proved to be an incentive in the development of time-saving and labor-saving devices and equipment.

For the most part, ideas for new developments in maintenance equipment are born directly in the field in the minds of those men who are constantly handling and working with the equipment and who can directly see the shortcomings of that equipment.

To develop better equipment and acquire new ideas is not only directly beneficial to themselves in performing maintenance tasks in an easier and more efficient manner, but is also an indication of their alertness in recognizing inefficiencies and overcoming them. The name of the employee who originally proposed or worked out a given idea is not always known, nor is a record available of all worthwhile developments. However, a brief description of the more recent developments is of interest.

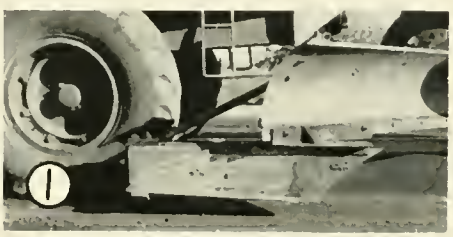
To Maintenance Superintendent F. R. Garrison of District III is credited the suggestion for a blade attachment for the front end of motor graders. This moldboard attachment, **Photo A**,



is used for spreading roadside cover material on penetration type oil surface treatments. In previous operations the front wheels of the motor grader were run in the oil ahead of the blade, thereby tracking oil and causing a weak spot in the seal.

At the termination of the construction of an asphaltic or Portland cement concrete pavement, it has been customary to allow timber header boards to remain in place. After several years, however, it is desirable to remove the old header boards and for this task Maintenance Superintendent L. D. Craig of District II designed a motor grader-attached device, **Photo 1**.

This attachment, bolted to the right end of the moldboard of a heavy grader, consists of a section of channel

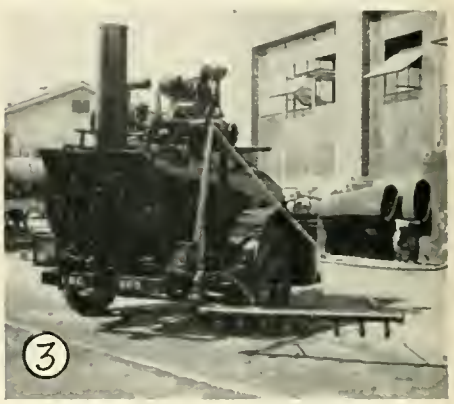


iron several feet in length and having an 8-inch depth of web. The forward edge of the channel section is cut to slope to the rear and base of the device and the flanges of the channel are set so as to extend outward from the assembly. The channel section is so positioned that the rear end is slightly higher than the front, which imparts the lifting action necessary to loosen and raise the header board when the web of the device is forced between the side of the header board and the vertical edge of the pavement, and the lower flange of the channel section is brought up under the lower edge of the header. As the grader moves forward, the header board, **Photo 2**, is raised four or



five inches above its original position from which point it can be easily removed with a bar or pick.

Emulsion kettles are not usually equipped with spreader boots, but are intended for use with hand sprays. In numerous instances, boots have been constructed to operate six to eight spray jets directly behind the kettle. To facilitate operations, a swivel joint connection, **Photo 3**, was designed and



built by Headquarters Shop to provide for bar spraying, either behind the unit or on an offset.

The operator of the hand spray formerly had to sit or stand on the frame or tank while the kettle was being towed at a slow speed. A rear platform, **Photo 4**, fitted with railing, was



added to the rear of the kettle by forces of District VI to afford safer operation and better control of the spray unit.

On many sections of highways, it is constantly necessary to remove rocks from the roadway by patrol maintenance. The operation of removing rocks from the pavement with a light snowplow is not necessarily new, but during the past emergency it was impossible to obtain light plows or to subject those on hand to the rigors of rock removing.

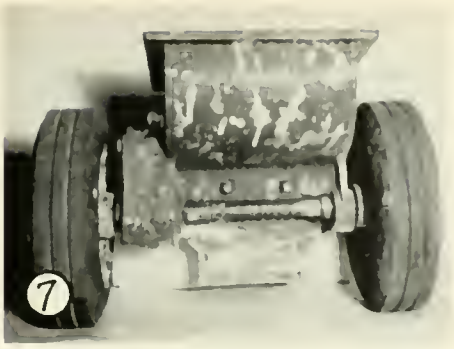
District I forces successfully built a front end truck-mounted rock removing plow using an old section of bumper type guard raid for a moldboard and a grader blade as a cutting edge. This plow, **Photo 5**, was so coupled that when the dump body of the truck was lowered, it rested on a lever which raised the dozer blade off the pavement and thus permitted normal operations of the truck, but when the body was raised, the weight of the plow caused it to lower and ride on the pavement on shoes.



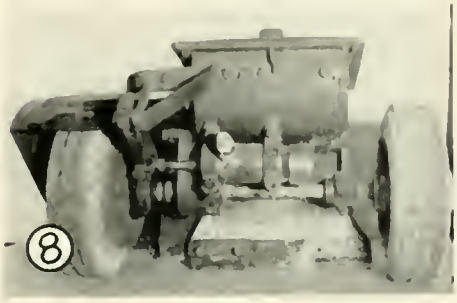
Under the supervision of Equipment Superintendent W. H. Pierce, then of Shop 2, a light plow, **Photo 6**, mounted on the front end of a truck was devised from materials on hand. This plow was raised or lowered by means of a hand-operated system of blocks.



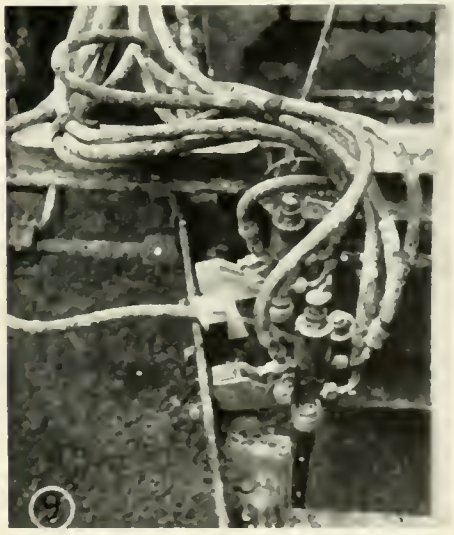
The first development in a mechanically controlled bead dispensing machine for use on dashed traffic striping was an air lift arrangement whereby the entire machine was completely raised from the pavement surface, **Photo 7**, thus stopping the flow of beads. Headquarters Shop further improved the machine by the installation of an air operated clutch, **Photo 8**,



which controlled the bead dispensing mechanism simultaneously with the lacquer control apparatus. Gates were also installed whereby beads could be applied to one or more stripes at a time. This operation previously required separate machines.



Under the supervision of Equipment Superintendent W. B. Cannon of Shop 7, a system for holding the spray guns on traffic striping machines, **Photo 9**, was developed whereby each spray gun is held separately by a clip sliding over



a square peg. When not in use, the spray guns are placed at the side of the paint spray rig. Before using the clips, it was necessary to drain the paint lines when changing from white to yellow lacquer, or if this were not done, to remove the paint guns, which required approximately 15 minutes labor. With the present arrangement, the nozzles may be instantly moved to any position.

A further development in traffic striping was the improvement of the



so-called "Dribble" Line Marker by Headquarters Shop in conjunction with M. A. O'Brien of Headquarters Office. This device, **Photos 10 and 11**, is used for applying a narrow temporary traffic stripe, approximately ½-inch wide, on newly placed surfacing to serve until the regular stripe is placed. It consists of a small wheel and paint container attached to the rear of, and trailing from a truck which



also has a guide pointer, **Photo 12**, mounted on the front bumper. Paint dripping onto the rotating trailing

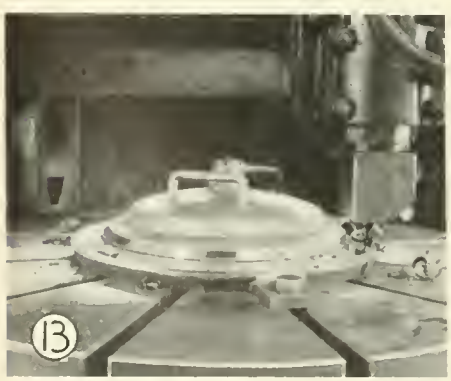
wheel leaves a satisfactory temporary line.

The original type of scarifier was fitted with discs made of a medium carbon steel and intended for agricultural purposes, but would not stand up for any length of time when used to scarify hard, abrasive surfaces. The discs for these scarifiers were sharpened by pressure between two rolls; however, when hard or heat treated alloy steel discs were introduced to meet the new requirements, the rolling machine would not produce a satisfactory even cutting edge, since the harder material



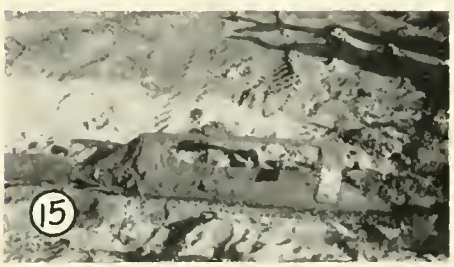
would not flow in the rolls and occasionally the discs split or chipped.

An edge grinding machine was successfully developed to sharpen the new type of discs and is now employed to do this disc reconditioning in the various district shops. At Headquarters Shop where a large boring mill is available, the resharpening of these hardened discs is accomplished by cutting their edges with an especially made cutting tool having a stellite facing, **Photo 13**. This method of reconditioning requires 50 per cent of the time for reconditioning each disc as compared to the grinding method. The reduction in diameter of the discs by cutting their edges is not sufficient to make any material difference in their life.





A tractor-powered culvert cleaning spoon, **Photos 14 and 15**, was a development of District VI's forces, and was first successfully used in Maintenance Superintendent Clyde Johnson's territory. This spoon is metal with an open top, about 10 inches in diameter and 36 inches to 48 inches in length, and has sharpened forward cutting edges. It is attached to the rear of a small tractor by a pipe 30 to 50 feet long with a cable for added strength and flexibility. The tractor operates the spoon by forcing it into the plugged culvert



and, after filling, the spoon is retracted, whereupon it is rolled over and dumped. Muddy or sticky material necessitates emptying the spoon by hand with a shovel. Two 6-inch x 6-inch timbers are placed at the culvert entrance to guide the spoon into the culvert. District IV forces have also used commercial type of sewer cleaning rods successfully to clear clogged culverts.

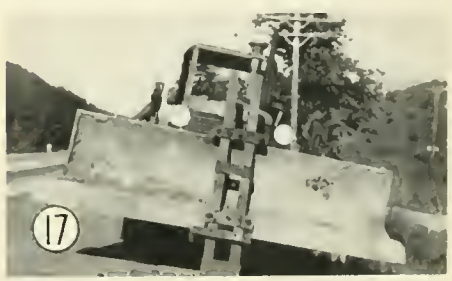
Cleaning culverts with the spoon is, of course, controlled by the grade of the culvert, by the fall of the inlet or outlet, and by fences, trees, or brush within the limits of the cleaning operation.

A portable tractor-mounted pile driving rig, **Photo 16**, was developed in District V by Maintenance Superintendent K. Mendenhall for driving rails used in the construction of wire fence bank protection and erosion control. A 17-foot boom was bolted to the drawbar back of the tractor. Two cables were fastened from the top of the boom to the dozer arm on either side of the tractor and the boom was raised or lowered by raising or lowering the dozer blade. The hammer guides were



made of 4-inch x 6-inch x 16-foot timbers fastened to 3-inch x 12-inch x 16-foot stiffeners. The lower end of the leads were then strut-braced to the drawbar of the tractor. A 500-pound hammer was operated by means of the tractor's power control unit.

Another tractor-mounted device developed by Superintendent Mendenhall, was the trench cutting tool, **Photo 17**, attached to the dozer. This was merely an assembly of two rails clamped to the dozer blade and having a flat cutting edge welded to the lower end. The tractor-mounted trencher



was successfully used in cutting narrow trenches across the shoulder in the installation of subgrade drains.

The coupling bars generally furnished by the manufacturers of screening spreaders are designed to clamp to the rear cross member of the frame of medium sized dump trucks. This cross member on the frame on large

trucks, such as are used for snow removal operations during winter, are generally too high above ground level to permit the direct attachment of the coupling bar. Shop 9, therefore, designed and built special brackets, adjustable in height, braced forward to the main frame, to accommodate the coupling bar supplied with the spreading equipment.

Shop 11 under the supervision of Equipment Superintendent R. J. Carlisle constructed a gravity flow screening unit, **Photos 18 and 19**, to be towed



and used behind a self-propelled force feed belt loader. It has removable screens fitting in frames of angle iron and may be equipped with a coarse screen at the top and used as a grizzly to eliminate oversize aggregate. For



elimination of both oversize and fines, a smaller mesh screen is inserted in the frame below the top screen. Material after screening is left in separate windrows and the waste can easily be removed with a blade.

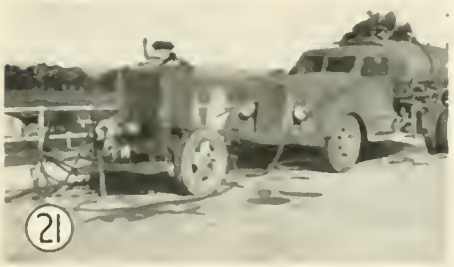
To facilitate the painting of the under side of the San Francisco-Oakland Bay Bridge (a constant and continuous operation) traveling scaffolds over 60 feet in length, **Photo 20**, have been suspended permanently under and at right angles to the line of the main bridge. These scaffolds, or painting bridges, are suspended from rollers riding on the top surface of the lower chord of the main bridge, and are propelled by means of hand-operated cranks at either end which must be operated simultaneously in order to produce an even travel of the scaffold.

"Road haze," a detrimental film or coating thrown from the pavement by



traffic, has been effectively and economically removed from the superstructure of bridges with a small portable steam outfit similar to that used in the cleaning of automobiles, **Photo 21**. Considerable areas of sound paint are uncovered in this manner, without damage or abrasion, thus eliminating the more costly sand blasting operations.

Previous shoulder weed spraying had been accomplished by means of a boom mechanism devised by Maintenance Superintendent Charles Harby, then of District XI, supporting the necessary hoses leading to the spray bar. E. S. Whitaker, Assistant Landscape Engineer of Headquarters Office, then devised the all-metal boom construction now used in roadside spraying. Construction of the lower portion of the boom of light-weight metal,



eliminates the dangerous and unwieldy system of hoses. A 180-degree lateral and 90-degree vertical movement of the boom is obtained through three Chicksan swing joints. The operator sits facing sideways in the truck cab with the door removed, allowing full vision and verbal communication between the spray bar operator and the truck driver. A by-pass valve at the pump permits constant agitation

(Continued on page 28)

Ford A. Chatters New Secretary Highway Body

WITH a background of experience as a legislator, leader for years in goods roads movements and newspaper publisher, Ford A. Chatters of Lindsay has been chosen by the California Highway Commission to be its secretary, a post that has been vacant since the advent of Governor Earl Warren's administration, due to wartime restrictions on highway building.

Announcement of Chatters' appointment was made by C. H. Purcell, Director of Public Works and chairman of the commission. Purcell said that in view of the extensive postwar highway program which has been undertaken by the State the commission requires the services of a liasion officer between the Highway Commission and State, county and city officials and members of the Legislature in carrying out the postwar highway construction program.

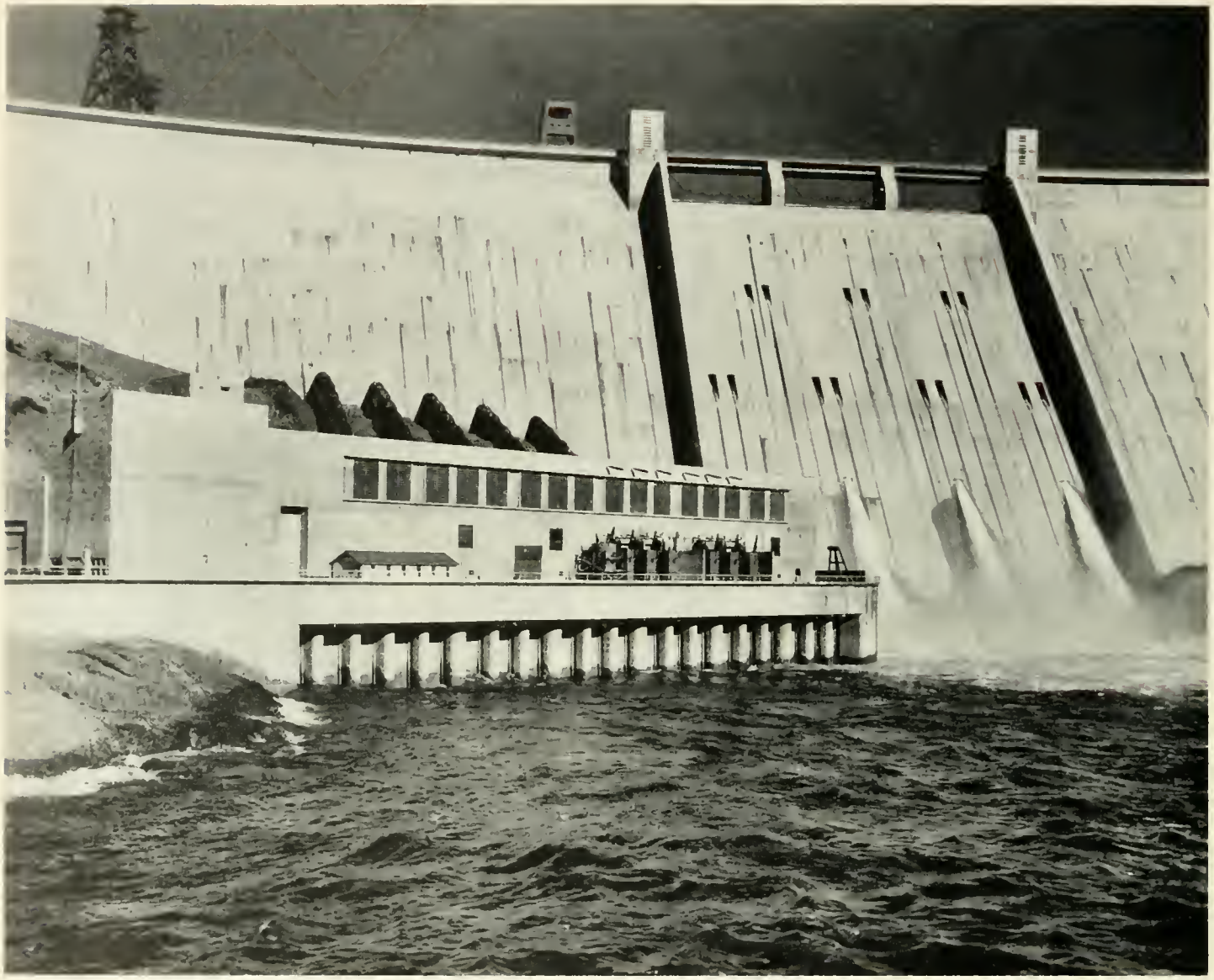
Members of the commission, Purcell said, have informally approved the selection of Chatters and will officially install him at its next meeting on February 20th and 21st.

Chatters, who is a member of the State Personnel Board, will resign from that office to devote his time to his new duties.

As a member of the Assembly of the Legislature during the 1933-35 sessions, Chatters, in 1933 took a prominent part in formulating highway legislation and served as a member of the Assembly Committee on Roads and Highways during the 1935 Session, working closely with the Division of Highways during his terms as a legislator.

Prior to his appointment on the Personnel Board, Chatters was a member of the State Board of Education. As a newspaper publisher since 1916 in Lindsay, Chatters has taken an active part in highway promotion. He was secretary of the Orange Belt Scenic Highway Association. While in the Legislature he also was a coauthor of the Central Valley Project Act.

Chatters, who publishes the Lindsay *Gazette*, is a past president of the California Newspaper Publishers' Association and Past Commander of Lindsay Post 28, American Legion.



Between December 29th and January 4th, water releases from Shasta Reservoir through the power plants and the four 102-inch flood control valves now installed were increased from 5,400 second-feet to 26,000 second-feet. This photo shows flood control valves in operation

Shasta Reservoir Operated for Flood Control

SHASTA Reservoir, major unit of the Central Valley Project, as operated by the U. S. Bureau of Reclamation, in the opinion of officials of that agency and the office of the State Engineer, is proving its effectiveness in the control of floods on the Sacramento River.

The peak flow of the Sacramento River near Red Bluff was 78,000 second feet on December 27th, which is about 60 per cent of the estimated peak flow that would have passed that latitude without Shasta Reservoir. Between December 22d and January 6th, there was detained for the first time 760,000 acre-feet of flood runoff in Shasta Reservoir, increasing the total storage therein from 2,520,000 acre-feet on the former date to 3,280,000 acre-feet on the latter date.

The present constructed capacity of Shasta Reservoir is 3,700,000 acre-feet which will be increased to 4,500,000 acre-feet when the three drum gates, each 28 feet in height and 110 feet in length, are installed on the crest of the dam. Releases from Shasta Reservoir through the power plants and the four 102-inch flood control valves now installed were gradually increased from 5,400 second-feet on December 29th, the amount passing through the power plants, to 26,000 second-feet on January 4th. This maximum rate of discharge was continued until January 12th when the quantity in storage had been reduced to 3,190,000 acre-feet which will provide 510,000 acre-feet of storage space available to retain subsequent flood flows. When the additional fourteen 102-inch flood control valves and the drum gates are installed, maximum flood control storage volume and releases can be increased

(Continued on page 36)

CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

Mission Santa Cruz
September 25, 1791

IN 1774, Father Francisco Palou, faithful friend and biographer of Fr. Serra, accompanied a surveying expedition from Monterey toward San Francisco. Returning, the party crossed the San Lorenzo River, near the present City of Santa Cruz, on December 11th of that year, and with prophetic vision Fr. Palou recorded in his diary:

"We reached the San Lorenzo River, which is quite large and has a deep bed; its water reached to the stirrups. * * * This site is suitable, not only for a pueblo, but even for a city, for it lacks nothing that is necessary, having good land, water, pasture, firewood and timber, all at hand in abundance, and close to the beach of Monterey Bay."

Fr. Palou strongly recommended to Fr. Serra that the location was an ideal spot for a mission. Junipero was not to live to see the founding of Mission Santa Cruz. This Franciscan station was established under the regime of his successor, Fr. Fermin Francisco de Lasuen. Fr. Lasuen took a personal pride in the selection of the site and recorded: "On August 28, 1791, the day of Saint Augustina I said Mass, and raised a cross on the spot where the establishment is to be. Many Gentiles came, old and young of both sexes, and showed that they would gladly enlist under the Sacred Standard, thanks be to God."

FIRST CONVERTS ARRIVE

However, Fr. Lasuen was not to be present at the dedication of the new mission. He was called to Monterey on pressing duties and the ceremonies were directed by Ensign Hermengildo Sal, acting commandant at the Presidio of San Francisco, who arrived at Santa Cruz on September 22, 1791, accompanied by Fathers Isidro Alonzo Salazar and Baldomero Lopez of Mission Santa Clara, who were destined to be the first missionaries at the new station.

On September 24th, neophyte Indians brought from Santa Clara were set at work by the padres building a rude shelter in which High Mass was to be celebrated the following day. The Indian chief, Sugert, came with some of his followers and asked to be made the first converts, and Ensign Sal agreed to act as godfather. Cows, oxen, steers, horses and mules contributed by the Missions of Santa Clara, San Carlos and San Francisco had arrived the day before.

Fathers Salazar and Lopez formally founded the mission on Sunday, September 25th and at the same time Ensign Sal took possession of the site in the name of His Majesty, the King of Spain. The site was about 500 yards from the San Lorenzo River in the shadow of the mountains and towering redwoods.

MISSION GROWTH RETARDED

Before long several buildings and a church had been erected. The first Santa Cruz Mission was but a temporary structure and later was moved a short distance to higher land. In December, 1791, the resident padres reported that they had baptized 87 persons, celebrated six Indian marriages and buried an Indian child.

"We have enclosed a place for cattle, sheep and horses," wrote Fr. Lopez. "We have brought the water to the mission, and we have fenced the orchard. The tools used at this mission belong to other missions, and we shall return them when we receive those which the King is going to send. We brought with us four candlestick of brass, a painting of our Lady of Sorrow, and an image of our Father St. Francis."

Santa Cruz Mission had one of the loveliest sites of all the Franciscan stations in California. The soil was fertile, the climate ideal, the Indians willing converts. And yet Santa Cruz never became a large or very prosperous mission. The padres attributed the failure of their dreams for a great mission to the fact that the Villa Branciforte, which was to become the present city of Santa Cruz, was established just across the river from them and was populated by settlers drawn from the lowest dregs of Mexican society.

EVIL OF VILLA BRANCIFORTE

The visitor to the Santa Cruz of today, one of the most attractive cities in the west and famed far and wide as a summer resort, will find it difficult to visualize the Villa Branciforte from which it grew and of which no trace of its unsavory existence remains.

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into nothern Washington.

Present day State highways lead to all the mission sites. Now that the war is ended, California looks forward to again welcoming tourists from all over the world. With the resumption of normal automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways is publishing in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions are taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the ninth of the series.



From Original Etching by H. Chapman Ford

This reproduction of an old etching shows what Mission Santa Cruz looked like in the days when the founding padres resided there

When Fr. Palou saw in this delightful spot an ideal place for a mission and "for a pueblo, even for a city," he could not foresee that the city he envisioned would turn out to be the Villa Branciforte, which brought so much grief to the mission fathers and shame to itself.

Santa Cruz Mission started out with great promise. The padres were inspired by the beauty of their surroundings.

"One can see them," writes H. A. van Coenen Torchiana, "standing on the hill, looking down upon the San Lorenzo River, lined with a great variety of deciduous trees, flowing through the small, lovely valley towards the west, or gazing towards the deep blue Bay of Monterey, on the opposite side of which the San Carlos mission and presidio were situated, and admiring the glorious sunsets over the Pacific Ocean. Then again they may have walked up the rock-strewn canyon of the upper San Lorenzo, its slopes covered with evergreens, and its audible waters boiling and tumbling in their steep descent over high boulders. We can not but hope that they knew and loved the small grove of Sequoia Sempervirens now owned as a public park by the County of Santa Cruz and situate only six miles up the gorge of the San Lorenzo from the mission site. No wonder Padres Isidro Alonzo Salazar and Baldomero Lopez, detailed by the Presidente as the first missionaries, considered themselves fortunate indeed. With all the joyous enthusiasm of religious zeal, they looked forward to their task at the lovely Mission of the Holy Cross, so favorably situated."

PADRES' HOPES DASHED

Alas, these high hopes were to be dashed and disillusionment was to come with the founding of Villa Branciforte.

However, the first few years were happy and busy ones. On February 27, 1793, the padres laid the cornerstone of the new mission church on the new and higher site. More than a year was required to build the edifice. The adobe walls were five feet thick. The front was of masonry and the foundation walls up to three feet in height were of stone, the rest of adobe.

The church was dedicated on May 10, 1794. The ceremonies were impressive. Father Tomaz Pena came down from Santa Clara for the event and Commandant Hermengildo Sal and several friars made the trip from San Francisco presidio. Indian neophytes and troops participated. The following day Mass was celebrated in the new church.

Building activities increased. A flour mill and granary and a house for looms were erected. The last two sides of the square of the mission building were completed in 1795. Progress was rapid up to 1797. And then came the founding of Villa Branciforte on July 24, 1797.

From this date on the histories of Mission Santa Cruz and the Villa Branciforte, named in honor of Miguel de la Grua Talamanca Marques de Branciforte, Viceroy of Mexico, are so closely interwoven as to make them one. The villa was established to gratify the conceit of the viceroy and over the protests of Fr. Presidente of the Missions Lasuen.

CHANGE IN MISSION AFFAIRS

So great was the change in mission affairs that we find Fr. Manuel Fernandez writing as early as January, 1798, that "everything was in a bad way; that 189 neophytes had deserted, leaving only 30 to 40 to do all the work; that the land was overflowed and only half of the planting done; that the livestock were dying; that a dead whale on the beach was attracting an unusual number of wolves and bears, and that the establishment of the Villa Branciforte added to the general despondency."

Five years earlier, Governor Don Diego de Borica had ordered secularization of the missions and the attempt to force self-government upon the Indians at Mission Santa Cruz brought much grief to the padres. The neophytes simply were not capable of ruling themselves or doing much for themselves.

Experiments with villas in Mexico had failed and conditions at the pueblos of San Jose and Los Angeles were anything but satisfactory.

In 1796, Fr. Salazar wrote to the Viceroy:

"The two towns formed twenty years ago have made no advancement. The people are a set of idlers. For them the Indian is errand boy, vaquero and digger of ditches—in short, general factotum. Confident that the Gentiles are working, the settlers pass the day singing. The young men wander on horseback through the rancherias soliciting the women to immorality."

SETTLERS BAD INFLUENCE

And Fr. Jose Senan at the same time went on record, saying:

"In Alta California the pueblos hardly deserve the name, so formless and embryonic is their state. The cause is scant relish for work on the part of the settlers. One is more likely to find in their hands a deck of cards than the spade or plow. For them the Gentile sows, ploughs, reaps and gathers the harvest. Debased, moreover, by the bad example of his white associates, the Gentile continues in the darkness of heathenism, when from distant rancherias many are won to the fold of the Holy Church."

Villa Branciforte was laid out on high, level land in what now is East Santa Cruz and a bridge was built across the San Lorenzo River to connect it with the mission. On May 12, 1797, nine colonists with their families, 17 persons in all, arrived. Torchiana says that the colonists, "recruited in Guadalajara from the vagabond type and undesirable classes, arrived in a pitiful condition at Monterey on the little ship Concepcion, which had sailed from San Blas. Their health was poor and they were destitute in body and soul, while some of them were diseased before they started."

Governor de Borica repeatedly tried to get a higher class of colonists, but with no success. He finally found it necessary to issue an order that no colonists should leave Branciforte without permission and violation of this decree was punishable by confinement in the stocks.

CONSTANT FRICTION

There was constant friction between the mission padres and the settlers. The priests considered that the villa was trespassing upon the lands and rights of the Indians. Nevertheless, they continued their activities in behalf of their wards and by 1800 had increased their livestock to 2,351 head. They were increasing the number of

This is Old Mission Church, erected on the site of the original Mission Santa Cruz



baptisms and adding to the mission building. In 1810, a large house had been constructed for widows and girls and except for constant trouble with rowdy settlers, affairs at the mission were fairly tranquil up to October, 1812, when Father Andres Quintana was found dead in bed. Murder was not suspected until later and then it required two years of investigation to determine that the friar had been strangled to death by a group of Indians and his body carried to his room and placed in bed. Nine or ten Indians were convicted of the crime and punished. Some died in jail.

In 1818 Monterey was raided by Argentine privateers and looted. Fearful that the pirates would cross the bay to Santa Cruz Mission, Father Olbes fled with his flock to Santa Clara. In his absence the mission was despoiled of everything that had not been buried by men working under direction of Comisionado Joaquin Buelna. The pirates could have done no worse.

SHIPS COME TO TRADE

With the coming in 1825 of Governor Echeandia, Mission Santa Cruz, as were the other California missions, was doomed. For more than a decade before that the mission had been compelled to furnish food and clothing to the Mexican troops, unpaid since inception in Mexico of the revolt against Spain. Santa Cruz Mission survived an attempt to suppress it in 1823 and the missionaries were forbidden to trade with vessels anchoring in Monterey Bay. In 1827 Santa Cruz was officially declared a port of entry and thereafter many ships stopped there and traded with the mission.

On August 22, 1834, Ignacio del Valle took charge of the mission as administrator under Governor Figueroa and on September 15th, Fr. del Real gave up his station. An inventory dated December 1, 1835, placed a value of $31,931 upon the mission and its property.

By 1842, the Santa Cruz Mission community was entirely broken up, the treasures and possessions of the mission had disappeared, the station was united with Branciforte, which de Valle in 1835 had named Pueblo de Figueroa, and the two communities were known as Pueblo de Santa Cruz. Father del Real remained as parish priest until 1844. Historian Bancroft says there is no record that any priest served the mission between 1844 and 1853, but Ernest de Massey, traveler and author, wrote that he called upon the padre in the mission in 1850. In 1853, the Rt. Reverend Jose Sadoc Alemany became Archbishop of San Francisco and revived Santa Cruz as a mission station, sending there Fr. Sebastian Filoteo.



This historical marker designates the site of Mission Santa Cruz founded in 1791

Santa Cruz Mission was returned to the Catholic church as represented by Archbishop Alemany and to his successors in trust by President James Buchanan on September 2, 1859.

In January, 1857, an earthquake crumbled the front wall of the mission building. Fr. Benito Capdevilla launched plans for rebuilding and on July 5th the cornerstone of the new church was laid and the structure itself completed a year later. The old mission gradually disappeared and the church of today, with many recovered treasures of the past, occupies part of the original site.

Visitors to Mission Santa Cruz coming from the north have the choice of several routes out of San Francisco to San Jose or Los Gatos, notably the Skyline Boulevard and El Camino Real, U. S. 101, thence over State Route 5 to Santa Cruz. From San Jose the motorist will follow Route 5 through charming Los Gatos and over the scenic mountain highway to Santa Cruz.

Visitors coming from the south will leave U. S. 101 at Salinas, go northwest through Castroville to Watsonville and thence 19 miles to Santa Cruz.

Mission visitors from the San Joaquin Valley will turn west at either Chowchilla or Califa and follow Route 32 west to Gilroy, thence westerly to Watsonville and then 19 miles north by west to Santa Cruz.

Santa Clara de Assisi
January 12, 1777

FOUNDED on January 12, 1777, Mission Santa Clara de Assisi today occupies the last of three sites chosen for it by its old padres. Originally established in the vicinity of Alviso near the Guadalupe River at a place called by the Indians Socoisuka, the mission was so severely damaged by floods in 1779 that it was removed in 1780 to a point just south of the Southern Pacific depot in Santa Clara. Here it remained until 1818. It had weathered the earthquake of 1812, but a second great temblor in 1818 so wrecked its buildings that it was reconstructed on its present site.

Fr. Junipero Serra had been desirous of founding Santa Clara years before the first mission was dedicated, but differences with Governor Neve and Captain Rivera y Moncada had delayed the event. The latter was stirred to action in September, 1776, when he received a letter from Viceroy Bucareli of Mexico in which the Viceroy clearly indicated that he believed Mission Santa Clara already had been founded.

Upon the receipt of this communication, Rivera hastened to make plans for the new station. Church goods and livestock were sent from San Francisco and from Mission San Carlos and Rivera followed with Fr. Pena. The site formally was claimed and dedicated and construction of buildings began at once.

MARAUDING NATIVES

At the outset, there were clashes with Indians of the vicinity who, having had their first taste of beef, developed such an appetite for it that they raided the mission corrals and stole cattle. Captain Moraga and a force of soldiers were sent for by Fr. Pena and the marauding natives were captured and punished, several being killed in combat.

Nevertheless, spiritual affairs progressed and by the end of the year a total of 67 baptisms had been recorded.

Following the floods of 1779, the padres began work on a new church, the cornerstone of which was laid with impressive ceremonies on November 19, 1781. The edifice was completed in 1784 and on May 15th of that year, Fr. Serra, assisted by Fathers Palou and Pena, proudly dedicated it in the presence of Governor Fages and Captain Moraga.

FATHER SERRA GROWS FEEBLE

This dedication was rather a sad one for the venerable Fr. Serra, Presidente of the Missions. He had made a farewell tour of his beloved Franciscan stations, fearing that his end was approaching. Indeed, at Mission San Gabriel the padres had been alarmed lest he die there before finishing his tour. The little Indian boys who served him at the altar while he was celebrating holy Mass at San Gabriel went to their padres with tears in their eyes and said: "The old Father wants to die."

However, Fr. Serra, past 70 years of age, made the long trip over the Mission Trail, arriving at San Carlos in January, 1784. The Fathers of Santa Clara had invited him to attend the dedication of their new church, the date of which had been fixed for May 16th. So Fr. Junipero began the arduous journey north on April 30th.

As he intended to dedicate the new house of worship on his return trip, he did not tarry at Santa Clara, but went

Little remains of Mission Santa Clara depicted here in the heyday of its prosperity



From Original Etching by H. Chapman Ford



Santa Clara University and this imposing church now occupy the site of the original Mission Santa Clara de Assisi

on to San Francisco, where he was received on May 4th by the faithful Fr. Palou. A few days later he was informed that Fr. Jose Murguia died on May 11th before he could witness the dedication of the church he had built and made the most imposing of any church building in California at that time.

Fr. Serra arrived at Santa Clara on May 15th and in the afternoon of that day he blessed the church and the following day, Sunday, he sang the High Mass and preached with exalted fervor. After holy Mass he confirmed all who had been prepared.

DEATH OF FATHER SERRA

The vigor of Fr. Serra rather surprised Fr. Palou and he suggested they return to San Francisco. But Junipero said he felt his strength failing and expressed a desire to prepare for death by making the last retreat at Santa Clara.

"Fr. Serra made the spiritual exercises for some days," Fr. Palou wrote, "and then he made a general confession, or repeated the one he had made at other times, while he shed many tears. Mine were not fewer, as I thought that this might be the last time we should see each other."

Completing his retreat, Fr. Serra returned to Mission San Carlos where, as we know, he passed to his reward.

Fr. Noboa succeeded Fr. Murguia at Santa Clara and his industry, coupled with the excellent soil and climate which the mission enjoyed, made Santa Clara second only to Mission San Gabriel in the amount of agricultural crops produced.

PROSPEROUS MISSION

In 1790, Santa Clara stood third in the number of converts and in 1800 it had the largest population of any of the Franciscan stations—1247.

Just three years before the establishment of the Mission San Jose de Guadalupe, on June 11, 1797, the eastern shores of San Francisco Bay were so little known that the missionaries at Santa Clara petitioned the commandante at San Francisco for permission to go into these lands in search of converts. They pointed out in November, 1794, that on account of a drought of that year and consequent shortage of food it would not be a difficult task to persuade the Indians in the unknown country to come to the mission.

Their request was refused, the commandante declaring that the country was "almost unknown, the natives perverse and the adventure too hazardous."

At the height of its prosperity in 1800 and for several years thereafter, the padres had considerable trouble with Indians at the missions and soldiers frequently were sent out to bring

in runaways and rebellious natives. In May, 1805, the priests had quite a scare. A story was brought to them that the Indians who had not been converted were planning a general massacre. A hurried call for help was sent to Monterey and San Francisco and troops hastened to Santa Clara from both presidios. However, an investigation proved that the wild yarn had been spread by certain neophytes who had hoped to escape floggings for misdoings by frightening the padres.

ATHLETIC PADRE

In between alarms during the troublesome decade following 1800, the priests found time in August, 1802, to consecrate with elaborate ceremonies a grand high altar brought from Mexico.

During this period, Fr. Viader, a powerful and athletic padre at Santa Clara gained no little renown. One night in 1814 he was attacked by a huge Indian known as Marcelo and two companions. The priest bested his three antagonists in a terrific rough and tumble fight and then forgave them. Marcelo became one of the Father's most devoted friends and followers.

The neophyte population in 1820 was 1357 and the mission possessed 5024 cattle, 722 horses and 12,060 sheep. By 1827, the population had reached its highest total of 1464. After that year the number of neophytes began to decrease and harvests of agricultural crops had dropped.

Fr. Viader's term of service with the California missions ended in 1833 after 10 years of missionary work and he retired to Mexico. He was succeeded by Fr. Francisco Garcia Diego, prefect of the Zacatecan friars, who later was to become the first bishop of California.

DECLINE OF MISSION

Santa Clara went through the same troublesome period following the advent of Governor Echeandia in 1835 that beset the other Franciscan missions and finally was secularized in 1837. Old Mission Santa Clara records reveal that in 1839-40 two-thirds of its cattle and sheep had vanished. By 1832 the neophyte population had been reduced to 1125, in 1834 it was 800 and at the end of the decade it had dwindled to about 200. The fall of this splendid missionary station was rapid.

A portion of the ancient adobe walls of Mission Santa Clara, which have been preserved down through the years



George Wharton James says that in July, 1839, a party of Indians called Yozcolos, doubtless after their leader, attacked neophytes guarding the Santa Clara wheatfields, killing one of them. The natives were pursued and their leader killed. The head of Chief Yozcolos was placed on a pole and this act seems to have discouraged attacks for some time.

"In December of the same year," says James, "Prado Mesa made an expedition against gentile thieves in the region of the Stanislaus River. He was surprised by the foe, three of his men killed, and he and six others wounded, besides losing a number of his weapons. This Indian success caused a great alarm, and a regular patrol was organized to operate between San Jose and San Juan Missions for the protection of the ranchos. This uprising of the Indians was almost inevitable. Deprived of their maintenance at the missions, they were practically thrown on their own resources, and in many cases this left them a prey to the evil leadership of desperate men of their own class."

RUIN COMPLETED

When Governor Micheltorena in March, 1843, ordered the missions returned to the padres, the friars at Mission Santa Clara endeavored to reassemble their flocks and herds, but found that they had been entirely dissipated by civil government authorities. Micheltorena's efforts to help the missions proved in vain.

The ruin of Santa Clara was completed under Governor Pio Pico. An inventory ordered by Pico placed a valuation of $16,173 on the mission and its property. On November 29, 1777, the pueblo of San Jose had been founded and there was constant friction between the padres and the town officials. As late as 1845 we find the resident missionaries complaining that the Indians had been demoralized by whiskey furnished them in the pueblo.

Mission Santa Clara became a parish church with Fr. Real in charge and in 1846 he was authorized to sell certain mission lands to pay debts and support himself. Settlers took possession of the mission but Padre Real obtained an eviction order.

On March 19, 1851, Santa Clara College was established in the old mission buildings. The college grew so rapidly that the mission structures were entirely renovated and enlarged so that little of the old church remains. In 1861-62 when restoration work was in progress the nave of the mission was allowed to remain, but later it was necessary to remove it. The reception room of the college today is a part of the old cloisters. Two of the three original mission bells remain.



The olive tree in the center foreground was planted by the padres when Mission Santa Clara was founded

Mission Santa Clara is in the city of that name three and one-half miles north of San Jose on U. S. 101. It is easily reached by mission motorists coming either from the south or north. Visitors from the San Joaquin Valley may follow State Route 32 from Chowchilla or Califa west to Gilroy, then north 9 miles to Morgan Hill, thence 20 miles north to San Jose. Or the route from the valley may be from Stockton by State Route 5 to Livermore, thence over Route 108 to Mission San Jose and south through Milpitas to Santa Clara or San Jose.

The mission is on the main street car line from San Jose to Santa Clara.

Next—Mission San Jose de Guadalupe and Mission San Francisco de Assisi.

HAMILTON P. PENN DIES SUDDENLY

At the moment that the annual convention of Associated Equipment Distributors in session in Chicago was installing F. B. McBath of Portland, Oregon, as his successor as president of the organization, Hamilton P. Penn, 51, widely known in the heavy construction machinery industry and State highway department circles throughout the country, died suddenly on Thursday, January 31, in the Edgewater Beach Hotel in Chicago.

New Sacramento River Bridge at Rio Vista Built at Cost of $727,858

By J. O. JAHLSTROM, Bridge Construction Engineer

REPLACEMENT of critical bridges on the State Highway System with structures capable of carrying legal loads and of adequate roadway width is one of the vital problems in the building of State highways to satisfactory modern standards.

The new Sacramento River bridge at Rio Vista, which was opened to traffic January 12, 1946, has been for years on the critical bridge list. The substandard roadway width, 18 feet 4 inches on the concrete portion and 20 feet 8 inches on the timber approach together with deterioration of the timber in the "A" frame trusses placed this structure among the top group of bridges needing replacement after the war emergency. The bridge was posted for speed in 1938 and had to be reposted for both load and speed in 1942 due to the weakened condition of the "A" frame trusses.

In 1944 the decay of the timber had reached such an extent that it was feared the bridge could not safely carry traffic until it could be rebuilt after the war. The increased importance of this bridge to the war effort made it imperative that the timber approach be reconstructed as soon as possible. This bridge is the only crossing over the Sacramento River on a through route south of the city of Sacramento. Failure of the bridge would have caused a long and costly detour of traffic.

OLD BRIDGE BUILT IN 1918

The old bridge was built in 1918 by Sacramento and Solano Counties at a cost of $261,238. In 1921 the bridge was taken over by the State when Route 53 was taken into the State Highway System.

Replacement of the east approach was required in 1927 due to flood damage to the short span timber trestle.

The reconstructed approach consisted of 41 40-foot "A" frame timber spans supported on five pile bents. Piles were treated Douglas Fir, 80 to 85 feet in length with 40 feet of penetration into the river bed. The work was completed in 1928 at a cost of $70,221.

Since 1928 the State has spent a total of $185,000 on repairs and improvements to the old bridge.

Various designs were made for the new approach. Steel stringer spans on concrete piles were considered at first. This design offered the advantages of fast construction and economy of cost. A serious disadvantage was the relatively short spans that would have been necessary in this type of design. The Sacramento River carries a large amount of drift and debris and a bridge at this location if built with short spans, particularly on pile bents, would be in danger of being destroyed.

DRIFT HAZARD REMOVED

A few years ago the present timber approach had such an accumulation of debris lodged against it that several spans were pushed downstream to such an extent that the bridge was closed to traffic. Each year, during periods of high water, the State maintenance crews stand by and remove the accumulations of drift that lodge against the present bridge.

A design was finally adopted that eliminated the hazard of drift and which would also fit in with the design of an entire new bridge for this crossing.

The final design is for 180-foot steel truss spans on concrete piers with steel pile foundations. The work completed at this time consists of seven truss spans of the proposed new bridge and seven 40-foot steel beam spans on timber pile bents. The short beam spans provide a connection between the new steel truss bridge section and the concrete section of the old bridge until such time as the new bridge can be fully completed. Under wartime restrictions it would have been impossible to secure the necessary material and equipment for the movable span of the new bridge.

The Sacramento River at this point is an important river arterial. Dur-

F. W. PANHORST NOW DIRECTOR OF A. S. C. E.

AT its annual meeting in New York January 14 and 15, the American Society of Civil Engineers elected Frederick W. Panhorst, Bridge Engineer of the California Division of Highways, a director of the society. Mr. Panhorst was elected an associate member in 1923 and member in 1933. For the last three years he has been chairman of the local membership committee for this area. In 1944 he was elected to the executive committee of the structural division; on which western representation has been rare. Mr. Panhorst is Past President of the Sacramento Section of the society.

Born in Andrain County, Missouri, Mr. Panhorst graduated from the University of Illinois in 1915, where he received his B.S. in civil engineering and later his C.E. degree. His early experiences included land surveying, mine surveying, construction of railroad bridges and mill building design. Two years after graduation from college, he came west as a naval architect for the Puget Sound Navy Yard in Bremerton. Later he return to the M. K. & T. R. R. as an assistant bridge engineer. In 1920 he went to Anaconda, Montana, where he designed several complete copper smelting plants for the Anaconda Copper Company for construction in South America. From 1921 to 1927 he was in charge of construction of several large bridges for the State of Washington.

Mr. Panhorst came to California in 1927 as Construction Engineer for the Bridge Department of the Division of Highways. In 1931 he was appointed Acting Bridge Engineer and has been Principal Bridge Engineer since 1936. He is an active member of the Structural Engineering Association of Northern California.

ing the war the number of bridge openings has been less than for the immediately preceding years. The amount of river traffic is better realized from the fact that 468 openings were required in one month last year. The proposed new deep water ship channel to Sacramento will undoubtedly increase the river traffic emphasizing further the importance of this bridge which must provide not only good highway but also good river traffic facilities.

The trusses of the new bridge are of the Warren type with verticals. The feature of the design is the appearance of the bridge as one continuous truss. The spans are alternately anchor and suspended spans, the symmetrical arrangement being provided by false members in the top chord at the ends of the cantilever arms of the anchor spans. This symmetry of design was effected by providing sliding pin assemblies at the connection of the suspended spans to the cantilever arms of the anchor spans.

TRUSS MOVEMENTS

Normally the movement due to expansion and contraction of trusses is taken care of at one end of a truss. This requires a fixed and an expansion shoe bearing at each pier. In this bridge the truss movements are taken care of at the panels where the sliding pins are located. Expansion joints in the concrete deck are provided at the pin panel points. With this design only one truss bearing shoe is required, effecting a large economy not only in truss bearings but also in the concrete piers.

The bridge piers consist of two circular concrete shafts connected with a web wall near the top. The concentric columns have an 8-foot diameter at the base, 5 feet at the bottom of the webwall, tapering to 4 feet 6 inches at the top. The footing block is 14 feet in diameter and 12 feet in thickness with a 9-foot tremie seal. The piers are an economic and well balanced design enhancing the general appearance of the bridge.

Truss details were designed with the basic idea of economy and appearance. The arched portals, K type lateral bracing, use of rolled sections and the triangular motif give the trusses a simple and graceful outline of good appearance yet of economical proportions throughout.

An S20-12 live load was used in the design of the bridge. Allowable unit stresses were: concrete 1,000 psi, steel 18,000 psi and $n = 10$.

The clear roadway width of the new bridge is 26 feet compared with

This photograph shows the striking contrast between the new and the old highway bridge across the Sacramento River at Rio Vista





A 26-foot roadway on the new Rio Vista Bridge allows ample room for passing traffic

20 feet 8 inches on the old bridge. The new bridge has two 4-foot sidewalks. There were no sidewalks on the old bridge.

In the construction of the piers a heavy steel sheet pile cofferdam was used for each pier shaft. Guide frames for the sheet piles were steel, pre-fabricated and held in position by temporary timber piles driven inside the cofferdam area. Sufficient cofferdam material for two complete piers was furnished which enabled the contractor to carry out a successful substructure program.

INGENIOUS METHOD

The contractor used a rather ingenious method in driving the steel H piles. A steel pipe, slightly larger than the steel H pile, was used as a guide for the piles. To locate the pile accurately, a coordinate frame arrangement was attached to the top of the sheet piles. The pipe was set for several feet in the sandy bottom and held in place by the frame at the top. The steel H pile was then placed inside the pipe and driven to grade by means of a specially constructed steel H pile follower.

Conventional methods were used in the erection of the structural steel. Timber piles framed into towers supported the steel during erection. A delay in steel shipment slowed up the work for several weeks. Except for the delay in steel delivery, rapid progress was made in the steel erection. Several spans were put up in less than a week per span.

An interesting feature of the bridge is the full length scuppers for deck drainage. This clear opening was provided by stopping the steel curb plate 4½ inches above the concrete roadway surface.

The vertical surfaces of the curbs and skid girders facing the roadway are painted white for better visibility at night. Other steel areas have an aluminum finish coat, the lustre of which sets off distinctly the steel members and details.

The major quantities of work were:

Structural excavation	2,500 cu. yds.
Class "A," footing block concrete	1,015 cu. yds.
Class "A," structural concrete	2,090 cu. yds.
Structural steel	3,285,000 lbs.
Steel piles (406)	19,040 lin. ft.
Reinforcing steel	320,000 lbs.

The contract for the bridge was awarded to Lord and Bishop and A. Teichert and Son, Inc., for the bid price of $727,858. Erection of the structural steel was sublet to J. H. Pomeroy and Co. Work was started on November 29, 1944, and completed on January 25, 1946.

ANGELES CREST HIGHWAY

By J. D. GALLAGHER, Associate Highway Engineer

This is the fourth in a series of articles on Highways of California by Mr. Gallagher.—Ed.

THE ANGELES CREST

That section of the San Gabriel Range of the Sierra Madre between the Verdugo Mountains and San Gabriel Canyon has long been a recreational area for the few who would venture into its rough and rugged isolation. Lying to the north of the foothill towns of Pasadena, Monrovia, Azusa and Glendora, these timbered mountains separate the fertile area east of Los Angeles from the arid Mojave Desert on the north.

This territory is a portion of the Angeles National Forest which comprises a total of 645,000 acres of these southern mountains. A large part of the area is 4,000 feet or more in elevation with many peaks reaching altitudes of between nine and ten thousand feet. For many years the section was largely inaccessible except by foot or horseback. The only roads of a public nature to this potential recreational area were 12-foot Forest Service trails constructed for fire protection purposes. Approach to these trails could be made only from the northerly or desert side of the mountains.

On the southerly side a few more or less primitive roads had been constructed up various canyons but they would dead-end when construction operations became difficult. Such roads extended into the Arroyo Seco at Pasadena, Santa Anita Canyon north of Sierra Madre and into the larger San Gabriel Canyon. The only real access from the south was by means of the narrow, steep and crooked toll road from Altadena to the top of Mt. Wilson and thence via a 26-mile narrow road built under a joint agreement between Los Angeles County and the U. S. Forest Service from Mt. Wilson via Red Box, Barley Flat and Chilao Flat to Buckhorn Flat. Although this route led through the Pasadena playground, because it was narrow and crooked, and the toll portion was operated under one way controls, relatively few motorists made use of it.

ANGELES CREST HIGHWAY

In 1929, the Division of Highways began construction on a projected State highway through this scenic area. The proposed routing involved development to State highway mountain standards from the Foothill Boulevard at La Canada through the upper Arroyo Seco into the higher elevations behind Mt. Wilson and on to Big Pines Camp. Similar development was projected, from connection with the Foothill Boulevard at Azusa up the San Gabriel Canyon through the Los Angeles County playground at Crystal Lake Park to a connection of the two highways on the northeasterly side of Mt. Islip. The new routing through the Forest was dubbed the "Angeles Crest Highway" and, when complete, the crescent between La Canada and Azusa will cover a distance of about 65 miles.

The first contract in 1929 covered the grading of 2.7 miles up the canyon from La Canada. This was followed in 1930, 1931, and 1933 by additional grading contracts which carried the highway 10.5 miles farther past Colby Canyon, to the Mt. Wilson Road at Red Box. Additional contracts for building bridges across La Canada and Fern Canyons were carried on simultaneously and contracts for oiling the roadbed surface followed the grading. During the depression years of 1931-32 and -33 the contract construction was supplemented by the work of free labor camps which were operated for unemployed men.

GRADE BUILT TO ISLIP SADDLE

In 1935 the State established a prison labor camp for construction operations on the nearly 20 miles from Red Box to Mt. Islip. This prison camp construction was continued at the higher elevations of the route until the operations were suspended in 1942 as unessential to the war effort. The first camp was established at Angeles Crest about 11 miles northeast of La Canada. A second camp was built at Chilao Flat and the Angeles Crest camp was later moved up to Cedar Springs. The highway constructed by the men from these camps is located at elevations from four to over seven thousand feet. At the time work was suspended the grade had been built to within less than a mile of Islip Saddle.

A small mileage of the route easterly of Red Box was constructed by the Public Roads Administration with U. S. Forest funds.

It is anticipated that when operations are resumed construction will push on to the east down the Swartout Valley through Big Pines Camp to a connection with the Lancaster Cajon Pass highway in San Bernardino County. It is also planned to complete, as soon as possible, the connection on the four miles between Islip Saddle and the San Gabriel Canyon highway at Crystal Lake Park. The latter proposed unit will close the circuit on this mountain highway between La Canada and Azusa.

SAN GABRIEL CANYON ROAD

Construction of the San Gabriel Canyon Highway under cooperative agreements between the State and the U. S. Forest service has been in progress concurrently with the Angeles Crest development.

Glib narration of the completion of one contract after another and of the eight years of prison labor work is not, however, indicative of the magnitude and difficulties encountered in building of this mountain highway. The grading on all sections was heavy rock construction with excavation quantities running into hundreds of thousands of cubic yards per mile and station yards of overhaul reaching more than a million for each of many miles.

For instance, on the contract for the four miles between Colby Canyon and Red Box the excavation totaled well over nine hundred thousand cubic yards and required more than 5,000,000 station yards of overhaul. In addition to the large quantities, the material was largely rock, as evidenced by the fact that, between Cedar Springs and West Islip Saddle, 80 per cent of the material had to be blasted.

Just westerly of Islip Saddle, where the line passed around a southerly shoulder of Mt. Williamson it was

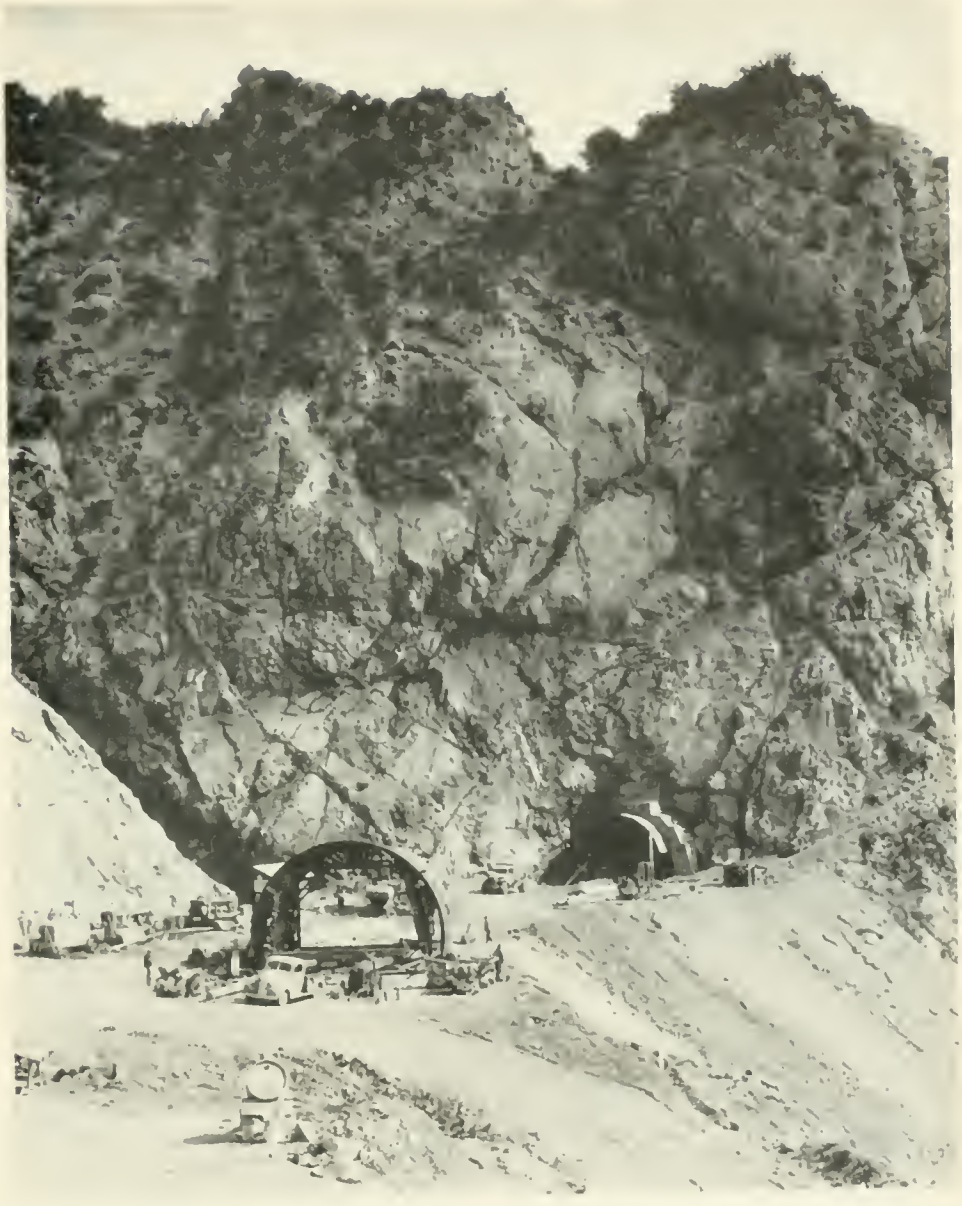
necessary to bore two tunnels through precipitous portions of the mountainside. To avoid building construction roads around the tunnel sites, a small pilot drift nine feet wide and ten feet high was rapidly bored at the crown of Tunnel No. 1. Air lines and drilling equipment were passed through this drift and excavation immediately started on the No. 2 bore. Thus it was possible to conduct full dimension operations on the two tunnels almost simultaneously.

During the period of building the Angeles Crest, difficulties other than those presented by construction were encountered. The historical storms of December, 1937, and March, 1938, which spread destruction throughout Southern California, did not spare the Angeles Crest from damage. At the lower elevations of the route the torrential rains washed tons of brush and debris down almost every depression, clogging drainage structures and backing up water behind the fills with the result that water washing across the road badly eroded many fill slopes and in some instances washed out the fill completely. An expenditure of $112,800 was required to restore the damaged portions of the roadway on 17 miles between La Canada and Tujunga Saddle; $140,900 was expended for erosion control and repair of storm damage easterly of Red Box.

PICTURESQUE PLACE NAMES

When the War Production Board's order to cease operations was received in 1942 construction had been completed on more than 35 miles from La Canada to Islip Saddle. During the 13 years between 1929 and 1942 the Division of Highways expended $3,177,000 on construction of the Angeles Crest Highway. In addition to this sum, the cost of the work performed by the Public Roads Administration for the U. S. Forest Service amounted to $887,600.

Interesting phases of the Angeles Crest Highway include the picturesque place names which have been given to the many features of the terrain. Such names as "Pinyon Flats," "Horse Flats," "Mt. Disappointment," "Buckhorn Flats," and "Chilao Flats," "Cloudburst Summit," "Fern Canyon," and "Cedar Springs" all seem to give a tang of the frontier to these mountains. The name "Red Box" is more prosaic, as this label came from the large box in which the Forest Service kept its fire-fighting tools and equipment.



Concrete tunnel lining form in course of construction for portal of tunnel No. 1 (in background) through Mt. Williamson on Angeles Crest Highway

While the desert side of the San Gabriel Range has always been rough, wild, and isolated, there have been a few rugged individualists who called it home. Near the Chilao campgrounds, the Angeles Crest Highway passes through the property of one of these hardy frontier men—the Newcomb Ranch. This 160-acre ranch was homesteaded in 1878 by Lewis Newcomb, and is the only privately owned land in this part of the Angeles Forest. Because of his knowledge of the passes and trails, many of which he first located and constructed, he was appointed one of the first forest rangers in the country, when the National Timberland Reserve was organized.

Two More States Pass Gas Tax Protective Acts

Kentucky and Pennsylvania, in the November 6th election of last year, joined the growing list of States which are safeguarding their highway revenues by constitutional amendments which prohibit the use of motor vehicle taxes for nonhighway purposes.

The successful campaign in Pennsylvania was under the sponsorship of the Pennsylvania Good Roads Association whose public education activities for this amendment resulted in a vote of almost seven to one for its enactment.

Postwar Highway Projects Advertised at the Rate of Two Million Dollars a Week

(Continued from page 1)



State Highway Engineer George T. McCoy and Assistant State Highway Engineer Fred J. Grumm have attended many meetings of the Joint Fact-Finding Committee on Highway Streets and Bridges. Left to right: Mr. McCoy, Senator Randolph Collier, Chairman, and Speaker of the Assembly Charles W. Lyon, Member, and Mr. Grumm

tration for their approval. The remaining 15 are in various stages of processing and review.

The Division of Highways has made an extensive study and appraisal of the 14,000-mile State Highway System and its current physical condition and capacities in the light of present and estimated traffic. From this study, it has developed that correction of the critical deficiencies of State highway facilities will require expenditures in the amount of $695,000,000 for construction, reconstruction and freeway development.

The projects included in the postwar program were selected as those most needed in a start towards correction of these critical deficiencies.

The $115,000,000 postwar program calls for construction and reconstruction of about 600 miles of State highways, approximately 180 new bridges, and 150 highway and railroad grade separations. The majority of grade separation structures are units in freeway development. The total estimated cost of bridges and grade separation structures will account for about one-fourth of the total program expenditures.

The program as adopted by the California Highway Commission is flexible and may be expanded by addition of other critical projects should revenues exceed present estimates.

For this first postwar year the Highway Commission approved an initial partial program totaling $40,000,000 in estimated construction cost. The projects in this initial program were selected from the total program and included the most critical, for which preparation of plans and right of way acquisition were sufficiently advanced for early advertising. In addition to such projects from the postwar program, there are included a number of bridge reconstruction jobs, which, under California statutes are specifically financed from Diesel tax funds.

This initial program provides for construction of approximately 200 miles of State highway on both primary and secondary roads, located in both urban and rural areas and distributed throughout both northern and southern sections of the State. There are included five railroad grade separations and 48 highway grade separation structures, most of the latter being units of freeway development in the urban areas of San Francisco, Los Angeles and San Diego. The program also includes 80 new bridges, which together with the grade separation structures comprise about ten million dollars of the $40,000,000 total for the first postwar year.

(Continued on page 30)

A. M. Nash Returns To Headquarters In Sacramento

CONTINUING the steady advancement that has been his in the Division of Highways since he entered State service in January, 1920, as an engineering draftsman, A. M. Nash has returned to Headquarters in Sacramento as Engineer of Surveys and Plans of the division. Since September, 1942, Mr. Nash has been District Engineer of District 1 with headquarters at Eureka.

Mr. Nash has been succeeded as District Engineer by George F. Hellesoe, Senior Highway Engineer, who was transferred from District IV in San Francisco.

In January, 1924, when District X was organized, Mr. Nash was employed there in field and office work until 1934 when he came back to Headquarters as Assistant Office Engineer. He filled this post and later that of Assistant Engineer of Surveys and Plans until February, 1942, when he was transferred to District IV in San Francisco as Assistant District Engineer.

Mr. Hellesoe joined the Division of Highway in April, 1918, after service in the army in World War I and with the Alaskan Engineering Commission in Alaska. He served the old U. S. Bureau of Public Roads in Colorado from 1920 to 1925 and returning to California served as District Maintenance and District Construction Engineer from 1920 to May, 1931, when he became Senior Highway Engineer in District 1. In July, 1939, he was transferred to District IV, San Francisco, going from there to his new position at Eureka.

San Francisco-Oakland Bay Bridge Peak Traffic Creates Problems

AN outstanding fact in the operation of the San Francisco-Oakland Bay Bridge in 1945 was the high intensity of traffic, especially during the period following the discontinuance of gasoline rationing. Even under the wartime gasoline restrictions during the first 7½ months of the year, the traffic was at a high level; but on August 15th it increased literally overnight from 61,000 to 71,000 vehicles a day. A new peak for a single day's business was reached on October 15th, the day Admiral Halsey's Third Fleet arrived in San Francisco Bay, when 78,646 vehicles crossed the bridge.

The heavy traffic of itself created a problem on the bridge because of its increased concentration during peak hours. The difficulties of handling the traffic, however, have been accentuated by other factors, the most serious being the large number of vehicles which become stalled on the bridge. About a third of these are automobiles out of gasoline. At least another third are in mechanical difficulty requiring tow service. Tire trouble, miscellaneous difficulties and mishaps account for the remainder.



Upholstery fires are just one of the many reasons for calling for emergency service

The bridge maintains an emergency service 24 hours a day to serve vehicles in distress. Until a few months ago the equipment for this service consisted of a fire truck, a heavy tow truck and three light tow trucks. To meet the needs resulting from the large increase in traffic, three additional tow trucks were ordered in October and delivery is expected as soon as automobile production conditions will permit. In the meantime, the service has been augmented by the use of four pickup trucks assigned to patrol the upper deck during the evening peak hours and equipped to furnish gasoline, change tires, or render other assistance short of towing. These extra trucks have aided materially in reducing traffic congestion and delays.

Other steps to improve the emergency service are under way, including the installation of radio equipment in the tow trucks to provide more rapid communication. Plans for enlargement of the Toll Plaza are progressing and construction of the additional facilities will be started in the near future.

In spite of the great increase in traffic, the Bay Bridge has continued to maintain a low accident record.

Cradle attachment on light tow truck provides quick hook-up for automobile towing





Four tow trucks and a fire fighting truck. These emergency units are ready day and night to serve patrons in trouble on the Bay Bridge

The heavy traffic on the bridge has created a public demand for a second bridge across the bay. Preliminary engineering investigations for such a bridge have been authorized and ordered by the California Toll Bridge Authority and are now in progress.

As in the preceding years of war, maintenance and operation of the Bay Bridge were handicapped in 1945 by the continued shortage of personnel. Toward the close of the year, however, this situation was relieved to some extent by the return of a number of former employees who had been absent

(Continued on page 36)

Four wheel drive heavy tow truck renders tow service to heavily laden truck and trailer on Bay Bridge



Bridge Maintenance Practice On California Highway System

By MERLE E. FISCHER, Associate Bridge Engineer

THERE are 4,636 bridges on the California State Highway System omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is $125,000,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenance and Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the eighth. It deals with Expansion Detail Failures.

ALMOST troublesome and costly item in the maintenance of bridges is the repair of a failed expansion detail. Expansion joint failures arise not only from movements due to temperature changes, but from pier and abutment movements resulting from scour and settlement and, in some cases, by earth pressures against the abutments and piers.

Provisions for expansion on structures within the State Highway system may be classified into four types as follows:

1. Rollers or rockers.
2. Sliding plates (2- and 3-element setups).
3. Building paper, asbestos packing or other light material.
4. Sliding granite or marble blocks.

With but few exceptions, the standard roller or rocker assemblies used on the larger and heavier structures give little or no trouble when movements are kept within the limits of design of the assembly. There have been instances, however, where unexpected pier movements occurred because of the pressure of the approach fill on one side of the pier. Where these movements exceed the limits of the assembly, damage to the rockers occurs. Repairs are made by jacking the structure free of the rockers and moving the bearing plates to new positions. This is sometimes difficult to do first, because the designer has often failed to provide means for jacking the structure and second, because the pier top is sometimes not constructed with sufficient width to allow for a great deal of shifting of the masonry plate. If the masonry plate is shifted too close to the edge of the pier, there is the ever-present danger of the pier top spalling.

CUMBERSOME ROCKERS

One small but important problem encountered when jacking a structure of this type is how to pick up the weight of the rockers in order to move the masonry plate. These rockers are usually very heavy and cumbersome, as may be seen in Picture No. 1. In this particular assembly, holes were drilled and tapped in the rockers and sole plate. The holes in the rockers may be seen in the photo. Short steel straps connected the rockers to the sole plate, and in jacking the structure the rockers were lifted at the same time. Although handled without too much difficulty in this instance, provisions to allow the raising of the entire assembly should be incorporated in the design.

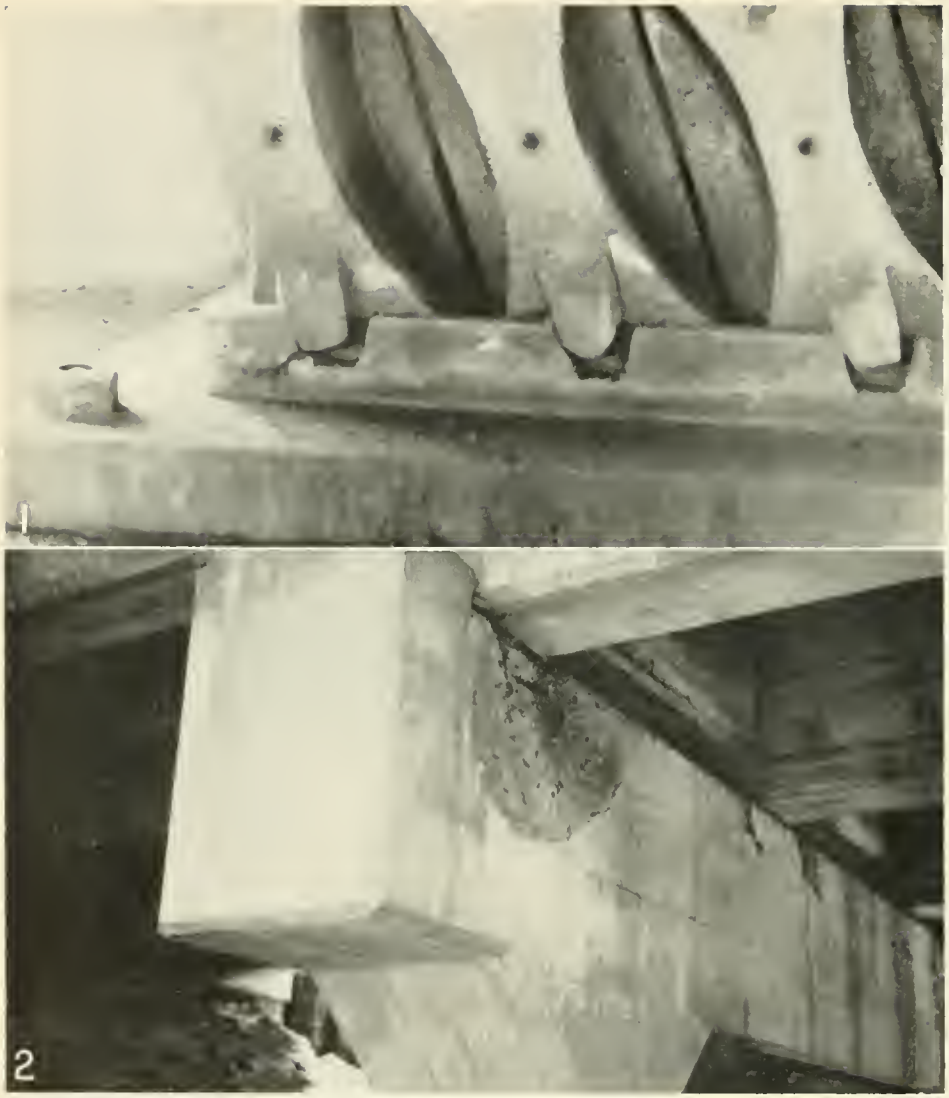
The use of steel or bronze expansion plates for concrete girder structures, a standard type of construction in the 20's and 30's, is the cause of considerable trouble in many structures. Inaccurate placing of the plates or improper placing of the concrete results in the spalling of the edges and sides of the cap or bridge seat. Freezing of the plates does not cause trouble if the cap is properly reinforced under the bearings. However, in the usual failures found, the cap was not properly reinforced and spalling resulted.

A specific example of the results of improperly placed concrete may be seen in Picture No. 2. The concrete was carelessly allowed to be built up above the sliding plane resulting in the spalling shown. This spalling generally starts in a small way, as may be seen under the far girder, and continues to progress to the size shown under the near girder. In some instances, not in evidence here, the girder bearings are found to be too long. Girder deflection results in edge bearing and subsequent similar spalling of the edges of the cap.

INTERESTING PROBLEM

The Bear River Bridge on State Highway Route 3 south of Wheatland presented an interesting problem. The structure consists of 57-foot, 5-inch reinforced concrete, two-girder spans with a total length of 690 feet. It was built in 1915. Sliding plate expansion joints were provided at the ends of every third span. These plates froze and because of weaknesses in design of the bearings considerable spalling of the concrete resulted.

Picture No. 3 shows a view of the flexible piers that were installed at one of the joints in 1921. Since failure occurred at the bearing seat, the existing pier was rendered useless unless a great deal of extra work was done. By putting in the extra wall piers, it was not necessary to put in any shoring. This type of joint was used on the two higher piers. At the locations where the piers were not as high, the existing pier was widened out at the top, the girders were notched the same as for the flexible walls and steel rockers were placed. No further troubles have developed since.



Upper—Damage to expansion assembly resulting from excessive pier movements. Lower—Spalled areas under expansion plates

During the past 10 years it has been the practice to place 1/16-inch asbestos packing between S. A. E. No. 64 leaded bronze expansion plates. Such provisions for expansion were usually placed on concrete structures of spans up to about 40 feet. Recently the Materials and Research Laboratory made an investigation of the condition of the packing material. Of the various structures investigated and from the actual removal of the packing from one, it was concluded that when properly installed, packing of the type used in constructions of the nature described may be expected to function indefinitely.

BRONZE PLATES HOLD UP

There was no evidence of any tendency for the packing to work from between the plates nor was there any evidence of deterioration other than the relatively small amount of abrasion. The bronze plates that were inspected were in excellent condition and there was no abrasion of the metal as the plates had not contacted each other.

As an example of the membrane type of joint, **Picture No. 4** shows the underside of a concrete girder and slab resting on a spandrel bent of a concrete arch bridge across the Kern River near Bakersfield. The bond between the two concrete surfaces had been broken by placing a membrane between them. The membrane layer developed the weak plane desired but the top surface of the cap was so irregular that when contraction occurred, concentrated pressure points were set up. The subsequent breaking up of the concrete is plainly seen in the photo.

Spalling has also occurred from a lengthening of the deck. **Picture No. 5** shows a part of the diaphragm over the same bent which has been broken off from movement of the slab. The reinforcing bars have been exposed in both cases. Repairs to date have consisted of the placing of a timber bent adjacent to the existing concrete bent to support the deck. The rate of progressive failure, i.e., a general shattering of the concrete, has greatly diminished since the construction of a new bridge paralleling this old structure in a divided highway setup. The structure is still in use for northbound traffic and extensive repairs will, undoubtedly, have to be made in the next few years.

COMMON FAILURE

Picture No. 6 shows an expansion failure which is commonly found in several types of joints. The structure is a reinforced concrete through girder built in 1915, and consists of eight 50-foot spans. The expansion joints consist of marble blocks 150 feet apart. Failure of this joint was progressive, it being first noticed in 1938 after 23 years of satisfactory service. Trouble developed to such extent that within a year, it was necessary to place supplemental supports under the girders.

Picture No. 7 shows the repaired joint. In making the repair, it was

Flexible piers added on Bear River Bridge



found that the reinforcing steel was not only poorly placed, but was in a rusted condition because of moisture entering through the cracks. The main tension steel in the bottom of the girders, being several inches short, did not properly reinforce the ends of the girder. The haunch of the column was not adequately reinforced and it could not furnish proper support for the ever-increasing amount and weight of truck traffic.

Rupture occurred by excessive diagonal tension or shear in the girder and haunch, which developed from failure of the marble expansion blocks to function. The repair cost was approximately $450 per joint. However, these repairs were made under very favorable conditions with the channel dry and the structure only 12 feet above the ground line. Under other less favorable conditions, the cost per joint could easily have been several times this amount.

NEW DESIGN TENDENCY

Numerous early-day concrete structures were constructed without any provisions for expansion. Instances are on record of such structures ranging in length from 20 feet to 216 feet, in which no particular difficulties were encountered although they are situated in regions subject to temperature changes ranging through more than 90 degrees.

There is a tendency in design today to lengthen the distance between expansion joints in order to reduce to a minimum the difficulties encountered. There is no set rule on how far apart joints should be. This will depend upon the type of structure, whether or not it is on flexible piers, what the approaches are, and the temperature ranges likely to be encountered.

Not all troubles are encountered in the supports. Taking satisfactory care of the movements in the deck of a structure also leads to many interesting problems.

In general, it has been the practice to armor the edges of deck joints usually consisting of angles anchored to the concrete. Normally used are 2-inch x 2-inch x ⅜-inch angles with 1-inch x ¼-inch hooked anchor straps. Experience has shown that, in time, the constant impact on the joint loosens the armor, the expansion joint material falls out and an unsightly and troublesome condition develops. The anchor straps are often broken. The repair of a joint of this type is costly



Failure of membrane type of joint due to contraction (above) and expansion (below)

and unless repairs are made immediately, the concrete not only becomes badly shattered but a hazardous traffic condition may develop. The minimum cost of repairs has run around $300 per joint.

CAUSE OF SPALLING

A few jobs have been constructed leaving the usual three-fourths-inch expansion joint open and leaving the armor protection off altogether. The plans called for a one-inch radius edger finish, the approximate natural spalling radius found on existing structures, but experience has shown that a worn out standard edger is usually used and not too much attention is given to such an apparent minor detail. Spalling results when an edging tool having less than one-inch radius is used; the joint becomes rough and impact stresses are stepped up. The opening is too small, rocks become lodged and dirt soon collects. Leaving the edges of a deck slab unarmored is no longer considered advisable.

A type of armored joint used on the Sacramento River Bridge at Redding and consisting of a channel equal to the depth of the slab may be seen in **Picture No. 8.** A deviation from the normal method of anchoring the armor has been used. Anchors consist of short sections of channels placed vertically and welded to the web of the armor channel. Note the breaks in the concrete slab exactly conforming to the section of the anchor channels. The slab has broken away



Upper—Samson Slough Bridge bearing failure. Lower—Same structure after repair work

from these anchor sections because the ends are too close to the surface. The channel has worked loose, the joint has failed badly, and it is very noisy under traffic.

WHAT CAN HAPPEN

Picture No. 9 shows what can happen to the cover plate type of joint. Trouble develops in this type of joint due to the use of too thin a plate. Dirt accumulates under the plate and the wedging action due to repeated expansion causes it to curl upward. The joint in general, becomes noisy. Failure of the particular joint shown occurred because the approaches to the steel truss span were constructed of timber. Shrinkage of the timber stringers and cap caused a general lowering of the deck leaving one edge of the plate unsupported.

It is impractical for a maintenance crew to continually keep the approach jacked to grade. Failure to maintain deck grade results in failure of the joint. The repair of a failed joint such as this one, sometimes requires complete removal and recasting of the assembly. The cover plate is also burned off and welded in place on the fixed span leaving the joint open. Not all such failures are attributable to structures having timber approaches. There have been numerous failures on structures having concrete or steel approaches but the damage is not always so great.

A very large percentage of these failures have been repaired by cutting off the cover plate as above because of an objectionable clanging every time a car travels across the joint. Joints as much as two inches have been left open with no ill effects.

TYPICAL EXAMPLE

The sketch **Figure (1)** shows the repair of a typical cover plate type of deck joint. The structure consists of a short timber trestle approach with the main spans of steel truss construction. Longitudinal movements occurred closing the joint and shrinkage of the timber stringers caused unequal deck elevations.

Because the fixed end of the cover plate was on the timber spans the assembly did not break up as in the previously discussed failure. However, the cover plate curled up and the concrete slab on the truss span spalled. Here the overhanging ends of the timber stringers were cut off, the slab on the timber span cut back and a structural Tee section was placed adequately anchoring the Tee to the reinforcing steel in the deck. The slab was also thickened for greater strength. When available, the Tee is cut from a 15-inch WF beam. The opening can be maintained for a number of years by burning off the Tee as required. If a 2-inch open joint is left subsequent movements amounting to seven inches can be accommodated before the joint becomes completely closed.

STOCK MOVEMENTS

The arguments advanced for the necessity of cover plates on joints one to two inches wide are that small animals such as sheep, may be injured in such openings. Present day conditions would seem to demand that movement of such stock except by truck on heavily traveled roads be not permitted; however, certain key locations might require provisions for such movements.

On roads where traffic is not too heavy and the movement of stock is more necessary and frequent, cover plate joints may be a satisfactory solution. In such cases, plates three-fourths inches or more in thickness are not too heavy and anchoring details must be made comparable in strength and weight if maintenance troubles are to be minimized. The finger type of joint ordinarily used where openings are exceptionally wide, has resulted in a very satisfactory type of construction with minimum trouble and expense.

The tendency of a concrete approach slab to crawl is a common source of trouble at expansion joints. During the past few years, the approach timber trestles to several movable bridges have been redecked either with a concrete slab placed on top of an existing laminated deck, or by removing the timber deck and placing the slab on sheet metal or plywood sub-floors. These slabs have been provided with expansion joints every two or three spans with the joints being filled with expansion joint filler. A one- to two-inch open joint was left at the juncture of the trestle with the movable span.

JOINT CLOSURE

Within a year after the slabs were placed, the joint at the movable span closed due to movement of the concrete slab or a general movement of the entire trestle approach. In all places where this trouble developed, the approaches are over 400 feet in length, the piles are long, the structure is very flexible and has little resistance to longitudinal movements. In one redecking contract, it was necessary to open up the joint before the contract was even completed. It has been necessary to open up the joint twice more since completion of the contract.

Even though the substructure may be relatively stiff, the joint will eventually close because of the tendency of the slab to creep on a smooth sub-floor. Specification requirements for expansion joint materials are such that the load required to compress the material 50 per cent of its thickness of one-half inch or less shall not exceed 1,500 pounds per square inch and it shall return to 90 per cent of its original thickness within one hour. The writer has seen no expansion joint material that will return to 100 per cent of its original thickness after a period of use in the field. As a result the small crack left in the joint after one cycle of expansion and contraction gradually becomes filled with fine particles, closing the joint.

CREEPAGE PROBLEM

Repeated cycles during the course of a year's time results in a general slippage of the slab on the sub-floor and where there are long approaches to a movable span, this creepage becomes a serious problem. The movement can be reduced by reducing the number of joints allowing greater opening at less frequent intervals and providing means of opening up the joints as previously discussed.

The opening at the ends of the bascule leaves of the Sacramento River Bridge near Rio Vista gradually lessened. A slight settlement was noticed just beyond the end of the westerly abutment. It was thought at the time, that the levee was moving towards the channel or that the concrete approach slab was pushing on the abutment. Soundings were taken around the abutment and there was no evidence of scour. During a very hot spell in the month of June, the joint completely closed. It was necessary to raise the leaves for a boat and before the bridge could again be reopened to traffic a heavy truck had to be run out to the ends of the leaves to force it down to its fully closed position.

CAVITY FILLED

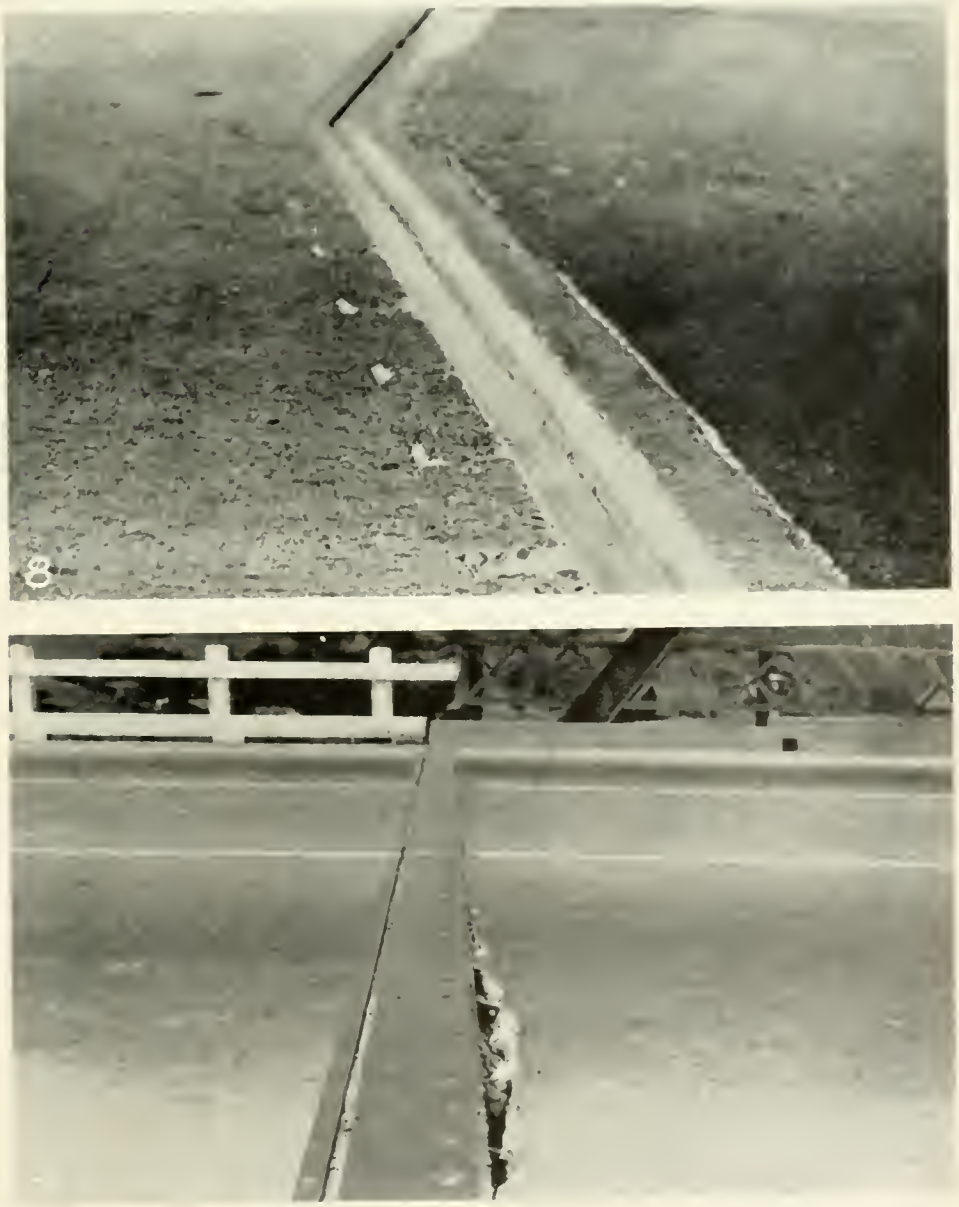
Steel was cut off; plates were removed where they could be, and the deck joint opened up. It was then decided to cut an opening across the approach concrete slab and fill with plant mix. A cut about one foot seven inches wide was made across the road way. An exceptionally hot spell one week later caused no additional closing of the joint at the end of the leaves. However, measurements taken at the opening in the pavement with the temperature less than 65 degrees showed that the cut had closed one and one-eighth inches.

Measurements taken August 24th showed the joint further lessened to a total of three and one-half inches, proving that the expansion troubles were due to a crawling of the roadway slab. The pressure of the slab against the abutment undoubtedly caused it to move towards the channel, closing the joint. The cavity behind the abutment wall was filled by a pounding of the fill material accounting for the settlement at the end of the bridge. Consequently, the abutment never will move back to its original position.

CONCLUSIONS

The present trend of constructing concrete pavements without expansion joints will undoubtedly lead to difficul-

Upper—Failure of deck joint edge armor. Lower—Typical cover plate type of deck joint and subsequent failure



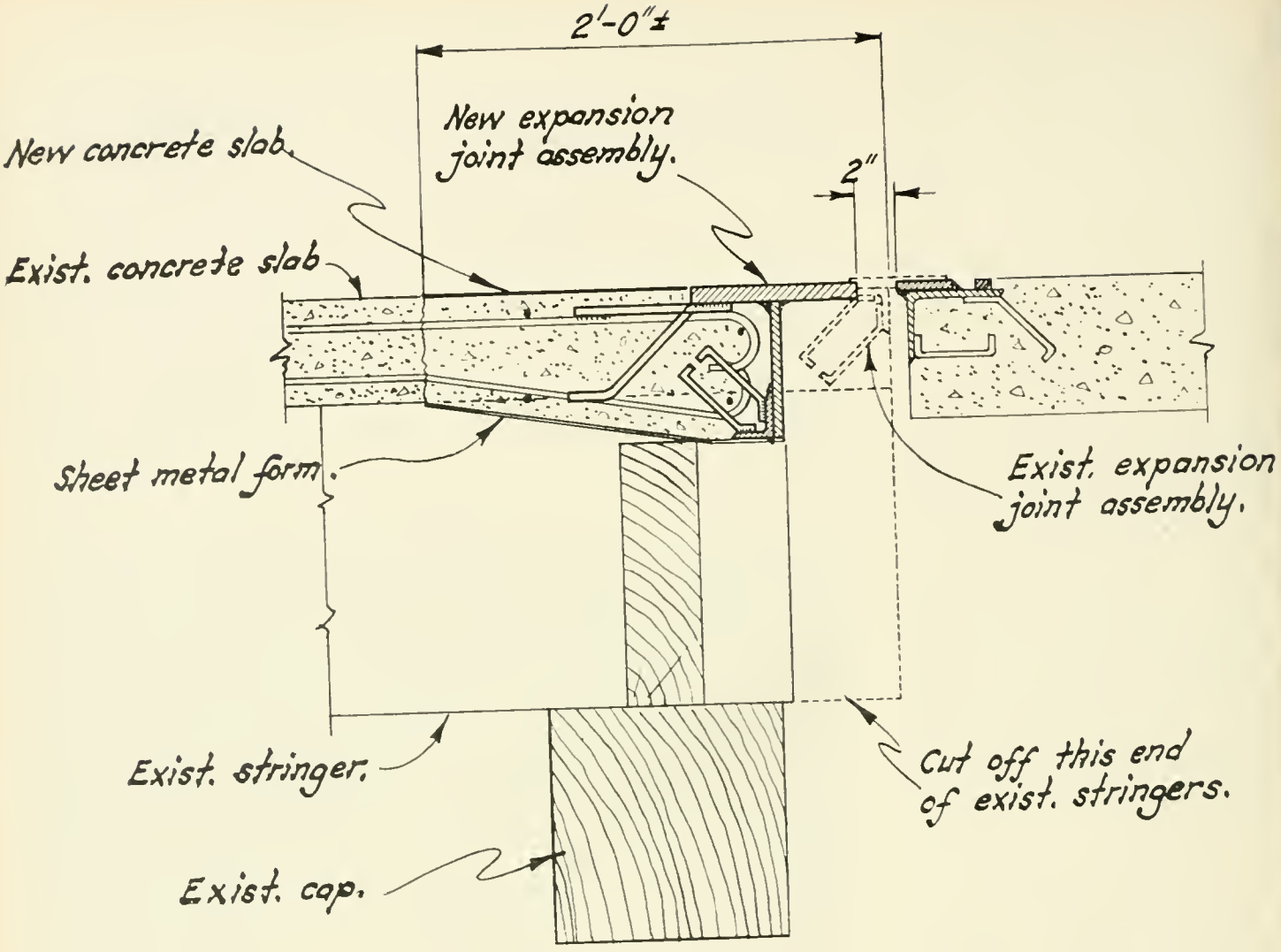


FIGURE 1

ties in maintaining proper openings at a draw bridge. Temporary corrective measures can be taken by placing Tee sections at the joints within the structure, but it is the writer's belief that further provisions must be made at the juncture of the approach slab with the ends of the structure.

Until recently, the details of expansion joint assemblies have been of a more or less common standard and not too much attention was paid to their proper functioning under the particular conditions or to maintenance in the field. With the advent of the continuous span structure, the number of deck openings have been materially reduced. It is contended that a further reduction in the number of expansion joints is altogether possible except for long span steel and concrete structures or movable spans.

Where joints are required, the following points should not be overlooked:

1—Possibility of large movements;

2—Necessary provisions for jacking with means of lifting the rockers or rollers at the same time;

3—Adequately reinforcing the edges of the concrete under the bearings;

4—Heavier design of edge armor combined with careful placing in the field.

"He said I was laconic."
"What does that mean?"
"I don't know, but, just to be on the safe side, I gave him a punch on the nose."

NEW DEVICES AID MAINTENANCE WORK

(Continued from page 5)

of the spraying material. The boom may be folded out of the way during traveling.

These newly developed devices have very materially aided in lightening the load of maintenance work, and have greatly reduced the amount of hand work and physical effort required in the performance of maintenance tasks. New ideas and new devices are always to be encouraged and it is anticipated that with the release of materials and expansion of highway work, many new methods and devices will be thought up.

Modified Cement Treated Base Experiment Made in District II

By J. W. TRASK, District Office Engineer

THE general practice in District II has been to resurface an existing surface, which has deteriorated to such an extent as to require attention, with an additional increment of plant-mix material varying in thickness from 1 to 3 inches.

This method of rejuvenating the traveled way has, in most cases, been satisfactory. However, there have been some instances in which the correction did not function as expected, in that the original plant-mix surface became unstable when covered with an additional increment.

The exact cause of the failures is as yet unknown. However, in most cases each failure had two things in common; one, a high percentage of material passing a 200 mesh; two, a high moisture content. Apparently the additional increment prevented evaporation with subsequent instability of the original surface.

EXPERIMENT SUCCESSFUL

On Road 11-Las-28-A, B between Nubieber Overhead and 8.3 miles east of Bieber the results of an additional increment were questionable. In order to provide a base that would not be susceptible to moisture content and that would carry heavy loads, it was decided to incorporate approximately 4 per cent of cement with the existing 3-inch plant-mix surfacing plus 3 inches of the existing base, to form a modified cement treated base, and place thereon a plant-mix wearing surface composed of 180 pounds per square yard open graded mix base course and a 60 pounds per square yard dense graded mix surface course.

Samples of material from the existing surface and base were submitted to the laboratory for testing with cement and the results were satisfactory.

SPECIFICATIONS

The specifications provided that the existing bituminous surface be thoroughly broken up by scarifying, discing or other means until it contained no particles that would not pass a one-inch laboratory sieve. This material was then to be spread uniformly over the area, and then the surface was to be scarified to a depth of 6 inches in such a manner as to leave an undisturbed plane of base material at a uniform depth. All material was then to be thoroughly mixed until a uniform mixture was obained. The loosened material was then to be formed in windrows, accurately shaped as to size and cross-section, to receive a uniform spread of cement.



Upper—Original surface after scarifying. Lower—Windrow after processing

In carrying out the operations of the contract, the contractor first scarified the existing oil cake, which broke into rather large pieces. This was then rolled with a sheepsfoot roller, disked, turned with a blade and pulverized with a mechanical mixer until all the oil cake was reduced to specified size.

The pulverized oil cake was then respread, and the material was scarified to a depth that would produce the required 6 inch compacted base. This material was then windrowed and pulverized with a mechanical mixer in order to break up any lumps of the existing base, and thoroughly mix the base and surfacing.

DUST OVERCOME

After dry mixing, there was no visual evidence of any oil cake. However, close inspection revealed that the oil cake had been coated with dust. Cement, which was shipped in bulk, was added by a distributor which made

a furrow in the top of the windrowed material and, at the same time, deposited the cement. The cement was spread to within a very small percentage of the amount required. The dry mix contained approximately 2.5 per cent moisture and sufficient water was added at the mixer to bring the water content to approximately 11 per cent in order to secure proper compaction. A road mixer was used to mix and make the initial spread of material. The material was then bladed to the proper width and thickness.

Compaction operations began immediately following the spreading operations. Compaction was secured by using a 12-ton, 3-axle type roller, and all compaction was completed within one hour after the mix was laid. The base was then trimmed by means of a self-propelled motor grader to the grade and section shown on the plans.

97 PER CENT COMPACTION

All material cut away by the blade was incorporated in the adjacent windrow of unmixed material. After trimming, the surface was rolled with a standard type, 2-axle, pneumatic tired roller. Water was applied during rolling as required, and the rolling continued until the base was smooth, closely knit and free from cracks and ridges. An average compaction of 97 per cent was secured.

Prior to laying the next lane, the existing lane was trimmed back to sound material, and the residue incorporated in the succeeding windrow. The joint was then washed with a spray to insure a satisfactory bond.

Immediately after finishing the base, it was covered with an asphaltic emulsion curing seal, and traffic was kept off until a satisfactory strength was secured. When traffic was turned over the base, it was necessary to apply sand, in order to keep tires from picking up the curing seal.

No detrimental results from the action of the traffic on the base have been noted, with the exception of spalling at the edges and some sealing. The small amount of sealing was corrected by applying additional asphaltic emulsion and sand.

The cement treated base averages 125 pounds per cubic foot and laboratory breaks range from 1,000 to 1,400 pounds in 7 days. Even 28 day breaks do not indicate that any substantial increase in strength can be expected. The exising oil cake and base, when mixed with cement, appears to take on the properties of concrete, in that transverse cracks appear every 15 to 25 feet with an average of approximately 20 feet apart.

Preliminary tests of fabricated samples at 100 degrees F. indicated a drop of approximately 30 per cent in strength, however, it is doubtful if the base will reach this temperature after the surfacing is placed.

It is too early to make any definite statement as to the durability of this base, but indications are that it will be satisfactory, and it will take another year to determine whether the results will justify any further work of this type.

The project was under contract to M. J. Ruddy & Sons and was under the general supervision of H. Clyde Amesbury, District Construction Engineer and under the direct supervision of C. I. Brown as Resident Engineer.

Freeway Development on Highways of California

As in all aspects of this ever-changing world, road and highway development has been subject to the processes of evolution.

The mud footpaths used by primitive man to and from his hunting grounds and other food sources, his water and fuel supplies, did not differ from the trails of wild animals with which he shared the vast forests, plains and hills of a young world. Through time, evolution of human desires and needs gave to the primitive paths increased importance. The camel, the horse, and oxen were domesticated to become beasts of burden and means of transport. The mud-packed trails became widened roads for commerce and war. Invention of the wheel and cart was followed by the constructed highway.

Seemingly, progress was slow but, as the centuries rolled along, came the Caesar's roads of stone, the corduroy of timber lands, the coach roads of England, France, and Spain, the military roads of the Georgias and the American turnpike.

Then came the automobile and highway development was accelerated as never before. During the past 40 years road construction has moved farther than in all the thousands of years preceding. In this country probably the most outstanding single development has been the 48 networks of State highway systems.

During the first two decades of State highway construction in California, when the cry was to get traffic out of the mud, activities were confined by statute to the building of rural roads. It was not until about 1931 that California law permitted expenditure of State highway funds for improvement of State routes through cities on a cooperative basis with the municipality.

The conception of spheres of responsibility for highway development was changing. In 1933 and 1935 the

(Continued on page 33)

Postwar Highway Projects Advertised at the Rate of Two Million Dollars a Week

(Continued from page 20)

The Division of Highways has made an excellent start in getting its postwar program under way and correction of some of the critical deficiencies in State highway facilities is now in progress. In the concentration of effort to advance the postwar program, however, the magnitude of over-all State highway deficiencies must not be forgotten and a long-range view of the problem must be held in mind.

Under anticipated State highway revenues from existing sources, needed correction of the $695,000,000 in critical deficiencies will require an estimated 30 years, a period which, under rapid present-day traffic changes, is far too long. If the problems of increasing traffic congestion are to be solved, means must be provided for speeding development of the State Highway System.

Highway Bids and Contract Awards for December 1945 and January 1946

December 1945

CONTRA COSTA COUNTY—At Antioch Bridge, a structure formerly used as toll house to be moved to new location for use as scale house. District X, Route 11, Section A. Contract awarded to M. A. Jenkins, Sacramento, $4,167.

KERN COUNTY—Across Los Angeles Aqueduct and Cache Creek, between 3.5 and 4.5 miles west of Mojave, two bridges to be constructed. District IX, Route 58, Section G. Fred D. Kyle, Pasadena, $101,202; The Tanner Construction Co., Phoenix, Arizona, $101,509; C. B. Tuttle, Long Beach, $107,221; Spencer Webb, Los Angeles, $117,430. Contract awarded to E. W. Elliott Construction Co., San Francisco, $93,612.

KERN COUNTY—Between Cameron and Mojave, about 7.2 miles to be graded and plant-mixed surfacing to be placed. District IX, Route 58, Section G. The Tanner Construction Company, Phoenix, $227,765; Heuser, Garnett & Hensler, Glendale, $239,766; Basich Brothers Construction Co. & Basich Brothers, Alhambra, $249,361; Oilfields Trucking Company, Bakersfield, $261,821; A. F. Heinze, Alhambra, $302,383; E. W. Elliott Construction Company, San Francisco, $311,520; Louis Biasotti & Son, Stockton, $323,093; Norman I. Fadel, North Hollywood, $332,728. Contract awarded to Gunner Corporation, Pasadena, $211,961.

MENDOCINO COUNTY—About 25 miles south of Garberville, a reinforced concrete arch bridge across Rock Creek to be constructed. District 1, Route 1, Section J. J. D. Proctor, Inc., Richmond, $111,618. Contract awarded to Fred J. Maurer & Son, Eureka, $83,607.

RIVERSIDE COUNTY—Between Mira Loma and 2.5 miles west of Riverside, about 5.9 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District VIII, Route 19, Section A. Griffith Co., Los Angeles, $657,557; E. W. Elliott Construction Co., Lynwood, $664,958; Peter Kiewit & Sons, Los Angeles, $696,212; Rhoades Bros. & Shofner, Los Angeles, $698,871; Guerin Bros., Los Angeles, $727,892; Matich Bros., Colton, $747,919; J. E. Haddock, Ltd., Pasadena, $761,533; Ralph A. Bell & A. F. Heinze, Monrovia, $777,758; Mittry Bros. Construction Co., Los Angeles, $789,513; Guy F. Atkinson Co., Long Beach, $842,350; Basich Bros. Construction Co. and Basich Bros., Alhambra, $912,231. Contract awarded to Geo. Herz Co., San Bernardino, $832,869.

SACRAMENTO COUNTY—On North Sacramento Freeway, between North Sacramento Viaduct and ½ mile east of Ben Ali, about 4.1 miles to be graded and paved with Portland cement concrete and freeway structures to be constructed. District III, Route 3, Section B. Chas. L. Harney, San Francisco, $1,789,033; A. Teichert & Son, Inc., and M. & K. Corporation, Sacramento, $1,839,526. Contract awarded to Guy F. Atkinson Company, South San Francisco, $1,683,674.

SACRAMENTO COUNTY—Across San Joaquin River about 5 miles north of Antioch, bridge fender to be repaired. District X, Route 11, Section C. M. A. Jenkins, Sacramento, $5,595; Pomeroy Sinnock, Stockton, $5,838. Contract awarded to H. F. Lauritzen, Pittsburg, $5,140.

SAN BERNARDINO COUNTY—Between Mulberry Street and Colton, about 9.8 miles to be graded and paved with Portland cement concrete. District VIII, Route 26, Section D, Ria. Matich Bros. & R. S. Crow, Colton, $1,403,865; H. Earl Parker & N. M. Ball Sons, Los Angeles, $1,432,751; J. E. Haddock Ltd., Pasadena, $1,452,538; Basich Bros. Construction Co. & Basich Bros., Alhambra, $1,477,221; Peter Kiewitt Sons Co., Los Angeles, $1,483,791; Guy F. Atkinson Co., Long Beach, $1,545,155; E. W. Elliott Construction Co., San Francisco, $1,549,833; Rhoades Bros. & Shofner, Los Angeles, $1,568,118; Mittry Bros. Construction Co., Los Angeles, $1,569,666; Hubert H. Everist, Sr., San Francisco, $1,619,313; Warren Southwest, Inc., & Chas. G. Willis & Sons., Inc., Los Angeles, $1,651,974; Brossi and Bevanda Constructors, Inc., Los Angeles, $1,668,772; Morrison Knudsen Co., Inc., Los Angeles, $1,741,739. Contract awarded to Griffith Co., Los Angeles, $1,386,769.

SAN DIEGO COUNTY—Over Balboa Park Freeway at Date Street, Upas Street, and Quince Street in the city of San Diego, three reinforced concrete overcrossings to be constructed. District XI, Route 77. Harry L. Foster, San Diego, $161,265; Byerts & Dunn, Los Angeles, $167,830; E. B. Bishop, Orland, $181,350; Contracting Engineers' Co., Los Angeles, $210,948; Barnch Corp., Los Angeles, $213,983; Spencer Webb, Los Angeles, $216,989. Contract awarded to M. H. Golden Construction Co., San Diego, $155,183.

SAN DIEGO COUNTY—Between San Luis Rey River and 0.2 mile north of Aliso Creek, about 1.9 miles in length, existing highway to be widened and paved with Portland cement concrete and portions of existing pavement to be resurfaced with asphalt concrete. District XI, Route 2, Oceanside. C. Griffith Co., Los Angeles, $571,732; N. M. Ball Sons, Los Angeles, $578,838; Peter Diewitt Sons' Co., Los Angeles, $609,904. Contract awarded to Basich Bros. Construction Co. & Basich Bros., Alhambra, $557,229.

SAN DIEGO COUNTY—Across San Diego River in the city of San Diego, a reinforced concrete bridge to be constructed. District XI, Route 77. Byerts & Dunn, Los Angeles, $188,520; Oberg Bros., Inglewood, $191,070; M. H. Golden Construction Co., San Diego, $191,087; Griffith Co., Los Angeles, $198,733; E. B. Bishop, Orland, $218,608; Spencer Webb, Los Angeles, $224,920; Guy F. Atkinson Co., Long Beach, $228,550; Contracting Engineers' Co., Los Angeles, $234,087; Macco Construction Co., Clearwater, $249,210; Barnch Corp., Los Angeles, $259,918. Contract awarded to Harry L. Foster, San Diego, $183,791.

SAN DIEGO COUNTY—About 1.7 miles east of Oceanside at San Luis Rey River and Keys Canyon Creek, two reinforced concrete girder bridges to be constructed. District XI, Route 77, Section G. M. H. Golden Construction Co., San Diego, $205,386; Haddock Engineers, Ltd., Pasadena, $239,807. Contract awarded to Spencer Webb, Los Angeles, $195,313.

SAN DIEGO COUNTY—One mile north of Oceanside, a structural steel overcrossing over the tracks of The Atchison, Topeka & Santa Fe Railway to be constructed. District XI, Route 2, Section C. Spencer Webb, Los Angeles, $88,386; Haddock Engrs., Ltd., Oceanside, $88,886; C. B. Tuttle, Long Beach, $89,087; Oberg Bros., Inglewood, $101,900; Basich Bros. Construction Co., Alhambra, $112,534; M. H. Golden Construction Co., San Diego, $113,225. Contract awarded to Fred D. Kyle, Pasadena, $87,848.

SANTA CLARA COUNTY—On Bay Shore Freeway, about 6 miles south of San Jose, a steel plate girder bridge to be constructed across Coyote Creek and a steel beam undercrossing to be constructed at Coyote Road. District IV, Route 2, Section E, Dan Caputo & Edward Keeble, San Jose, $307,067; J. H. Pomeroy & Co., Inc., San Francisco, $311,708; Carl N. Swenson Co., San Jose, $316,636; Chas. L. Harney, San Francisco, $319,805; J. D. Proctor, Inc., Point Richmond, $319,252; Fredrickson & Watson Construction Co., Oakland, $321,523; Macco Construction Co., Oakland, $338,841; Fred J. Maurer & Son, Eureka, $345,042; E. W. Elliott Construction Company, San Francisco, $361,850; Guy F. Atkinson Company, South San Francisco, $361,889; Pittsburg-Des Moines Steel Co., Mountain View, $369,912; Healy Tibbitts Construction Co., San Francisco, $388,591. Contract awarded to Earl W. Heple, San Jose, $274,758.

An Appreciation

"BOURNESIDE"
State Highway 1, at Hudson Hill
Bolinas, Calif.

5th January, 1946

Colonel John H. Skeggs,
2001 Van Ness Ave.,
San Francisco

Dear Colonel: I want to take this opportunity to bring to your attention the excellent work accomplished by the road crew, under Mr. Jack Barrett, working south out of Point Reyes Station.

I have resided over here for the past eight years (with the exception of the last two years which I have spent on active duty as a commissioned officer in the Army) and commuted daily to San Francisco.

Mr. Barrett and his crew have done an excellent job at all times, and especially of late when the highway has been flooded by high waters. Flares have marked every danger zone, along with other signs, and my friends have also remarked that we can immediately tell when we strike that part of the highway under the supervision of Mr. Barrett.

I feel that these men are also a part of our "unsung heroes" and for this reason I am drawing to your attention, sir, the excellent work they have accomplished under the most adverse conditions. A word of praise is very encouraging to them to keep up the excellent work they are doing.

I am, sir,

Yours very truly
HUGH H. SAMSON

SANTA CLARA COUNTY—On Bay Shore Freeway at Ford Road, about 6 miles south of San Jose, a structural steel undercrossing to be constructed. District IV, Route 2, Section E. Carl N. Swenson Co., San Jose, $72,450; Kiss Crane Co., San Pablo, $73,567; Chas. L. Harney, San Francisco, $77,145; Johnson, Drake & Piper, Inc., Oakland, $77,209; Dan Caputo & Edward Keeble, San Jose, $77,309; E. W. Elliott Construction Company, San Francisco, $79,580; Stockton Construction Co., Stockton, $79,937; J. D. Proctor, Inc., Point Richmond, $80,758; Fred J. Maurer & Son, Eureka, $83,261; George Pollock Co., Sacramento, $84,099; Fredrickson & Watson Construction Co., Oakland, $84,674; Macco Construction Co., Oakland, $95,586; Peter Sorensen, Redwood City, $105,739. Contract awarded to Earl W. Heple, San Jose, $65,031.

SANTA CLARA COUNTY—Between San Jose and 0.6 mile south of Ford Road, about 8.1 miles to be graded and paved with Portland cement concrete. District IV, Route 2, 8.1s,E. Fredrickson & Watson Construction Co., Oakland, $1,186,864; Union Paving Co., San Francisco, $1,191,844; The Utah Construction Co., San Francisco, $1,258,926; Guy F. Atkinson Company, South San Francisco, $1,292,054; Earl W. Heple, San Jose, $1,292,896; Chas. L. Harney, San Francisco, $1,331,015; Macco Construction Co., Clearwater, $1,349,487; Peter Kiewit Sons' Co. & Hubert H. Everist, Sr., San Francisco, $1,359,987; A. G. Raisch Co., A. J. Raisch Paving Company, & Harms Bros., San Jose, $1,391,748; E. W. Elliott Construction Company, San Francisco, $1,392,290; Morrison-Knudsen Company, Inc., Los Angeles, $1,529,399. Contract awarded to N. M. Ball Sons, Berkeley, $1,178,869.

SOLANO COUNTY—Between Ulatis Creek and Midway, about 6.0 miles to be graded and paved with Portland cement concrete and bridges to be built across Horse Creek and Gibson Canyon Creek. District X, Route 7, Section Vac.D, N. M. Ball Sons, Berkeley, $576,219; Fredrickson & Watson Construction Co., Oakland, $683,235; Guy F. Atkinson Company, South San Francisco, $747,075; E. W. Elliott Construction Co., San Francisco, $743,131; Marshall S. Hanrahan, Redwood City, $560,396; Gunner Corporation, Pasadena, $615,882; M. J. B. Construction Co., Stockton, $618,237; Parish Bros., Benicia, $652,579; A. Teichert & Son, Inc., Sacramento, $663,645. Contract awarded to Fredrickson Bros., Emeryville, $527,735.

YUBA AND SUTTER COUNTIES—Across Feather River at Marysville and Yuba City, and in Sutter County over the Southern Pacific Railroad and at Sutter Street in Yuba City, a bridge, overhead crossing, undercrossing and approaches to be constructed. District III, Route 3, Section Mvl., Y. C. United Concrete Pipe Corp. & Ralph A. Bell, Los Angeles, $1,956,023; Clinton Construction Co. of California, San Francisco, $1,966,719; Pacific Bridge Company, San Francisco, $2,069,614; George Pollock Co., Sacramento, $2,099,016; Johnson, Drake & Piper, Inc., Oakland, $2,252,417; Guy F. Atkinson Company, South San Francisco, $2,357,155. Contract awarded to J. H. Pomeroy & Co., Inc., San Francisco, $1,879,340.

January 1946

FRESNO COUNTY—Between Calwa Overpass and Fresno, about 2.1 miles to be graded and paved with Portland cement concrete. District VI, Route 4, Section B, Fresno. J. E. Haddock, Ltd., Pasadena, $346,400; Gunner Corporation, Pasadena, $352,280; M.J.B. Construction Co., Stockton, $382,584; Louis Biasotti & Son, Stockton, $382,680. Contract awarded to Marshall S. Hanrahan, Redwood City, $337,722.

HUMBOLDT COUNTY—At Mad River, a steel girder and concrete girder bridge to be constructed and road approaches about 0.2 mile to be graded and surfaced with plant-mixed surfacing on imported base material. District I, Route 20, Section A. J. D. Proctor, Inc., Richmond, $220,559; Fred J. Maurer & Son, Eureka, $226,387. Contract awarded to Mercer, Fraser, Eureka, $204,868.

KINGS COUNTY—Between Fifth Standard Parallel South and 1.5 miles north, about 1.5 miles to be graded and surfaced with road-mixed surfacing. District VI, Route 125, Section D. George E. France, Visalia, $75,989; Phoenix Construction Co., Bakersfield, $77,090; Milo A. Browne, Palo Alto, $82,128; J. Henry Harris, Berkeley, $82,152; Louis Biasotti & Son, Stockton, $84,490; Volpa Brothers, Fresno, $88,353; Combs Brothers, Bakersfield, $94,528; Brown, Doko & Baun, Pismo Beach, $96,996; J. E. Haddock Ltd., Pasadena, $101,716; Guerin Bros., South San Francisco, $118,135. Contract awarded to W. C. Railing, Redwood City, $70,408.

LASSEN COUNTY—Between 1.5 miles west of Bird Flat and Doyle, about 7.5 miles to be graded and surfaced with plant-mixed surfacing. District II, Route 29, Section D. Isbell Construction Co., Reno, $239,558; Marshall S. Hanrahan, Redwood City, $245,117; H. Earl Parker and Clements & Co., Marysville, $246,943; A. R. McEwen, Sacramento, $247,901; Harms Bros., Sacramento, $249,910; R. A. Westbrook, Sacramento, $259,476; Louis Biasotti & Son, Stockton, $274,443; Parish Bros., Benicia, $279,227; Combs Bros. and A. A. Tieslau & Son, Berkeley, $286,461; E. B. Bishop, Orland, $289,709; Frederickson & Watson Construction Co., Oakland, $305,369. Contract awarded to Utah Construction Co., San Francisco, $229,057.

LOS ANGELES COUNTY—On Santa Ana Parkway at Fourth Street in the city of Los Angeles, a reinforced concrete overcrossing to be constructed. District VII, Route 2. Oberg Bros., Inglewood, $132,716; Contracting Engineers Co., Los Angeles, $143,390; Spencer Webb, Los Angeles, $148,577; Guy F. Atkinson Co., Long Beach, $149,225; J. E. Haddock Ltd., Pasadena, $157,047; Mittry Bros. Construction Co., Los Angeles, $172,188; Baruch Corp., Los Angeles, $181,448. Contract awarded to Byerts & Dunn, Los Angeles, $128,290.

LOS ANGELES COUNTY—On Santa Ana Parkway between Kearney and Soto Streets, about 1.6 miles to be graded and paved with Portland cement concrete and asphalt concrete. District VII, Route 2. Griffith Co., Los Angeles, $1,372,281; Guy F. Atkinson Co., Long Beach, $1,383,605; E. W. Elliott Construction Co., Lynwood, $1,457,313; J. E. Haddock, Ltd., Pasadena, $1,586,421. Contract awarded to Peter Kiewit Sons' Co., Los Angeles, $1,333,066.

LOS ANGELES COUNTY—On Santa Ana Parkway at Seventh Street in the city of Los Angeles, a reinforced concrete overcrossing to be constructed. District VII, Route 2. Oberg Bros., Inglewood, $222,418; E. B. Bishop, Orland, $228,826; Contracting Engineers Co., Los Angeles, $249,853; Guy F. Atkinson Co., Long Beach, $268,727; Spencer Webb, Los Angeles, $270,913; Baruch Corp., Los Angeles, $272,466; J. E. Haddock, Ltd., Pasadena, $273,018; Mittry Bros. Construction Co., Los Angeles, $291,616; Carlo Bongiovani, Hollywood, $299,769. Contract awarded to Byerts & Dunn, Los Angeles, $219,901.

PLACER COUNTY—Across East Street in the city of Auburn, a bridge to be constructed and incidental grading work to be performed. District III, Route 37. Kiss Crane Company, San Pablo, $65,706; A. Teichert & Son, Inc., Sacramento, $71,417; Chittenden & Chittenden, Auburn, $67,008; S. J. Amoroso Construction Co., San Francisco, $68,816; R. A. Westbrook, Sacramento, $71,683; M. J. Ruddy & Son, Modesto, $74,424. Contract awarded to H. W. Ruby, Sacramento, $60,720.

PLACER COUNTY—In the city of Auburn, a reinforced concrete undercrossing to be constructed at Walsh Street. District III, Route 37. H. W. Ruby, Sacramento, $30,781; M. J. Ruddy & Son, Modesto, $31,114; C. M. Allen, Fairfield, $34,253; Kiss Crane Company, San Pablo, $38,852; R. A. Westbrook, Sacramento, $39,554; S. J. Amoroso Construction Co., San Francisco, $40,273; da Roza & Billeter, Stockton, $41,647; A. Teichert & Son, Inc., Sacramento, $42,797. Contract awarded to Wm. E. Thomas Construction Co., Tustin, $30,553.

PLACER COUNTY—In the city of Auburn, a steel beam span overhead crossing over the tracks of the Southern Pacific Company to be constructed. District III, Route 37. R. A. Westbrook, Sacramento, $98,988; S. J. Amoroso Construction Co., San Francisco, $101,551; Kiss Crane Company, San Pablo, $104,446; A. Teichert & Son, Inc., Sacramento, $105,162; Chittenden & Chittenden, Auburn, $106,870; E. B. Bishop, Orland, $118,360. Contract awarded to H. W. Ruby, Sacramento, $88,550.

SANTA BARBARA COUNTY—Between Hollister Wye and Fairview Avenue, about 3.7 miles to be graded and surfaced with plant-mixed surfacing and two reinforced concrete slab bridges to be constructed. District V, Route 2, Section Q. Griffith Company, Los Angeles, $587,259. Contract awarded to Dimmitt & Taylor, Los Angeles, $503,947.

SAN DIEGO COUNTY—About 6 miles west of Campo, across Campo Creek, a steel beam span bridge and approaches to be constructed. District XI, Route 200, Section D. M. H. Golden Construction Co., San Diego, $103,742. Contract awarded to Walter H. Barber, San Diego, $74,694.

SONOMA AND MARIN COUNTIES—Between one mile south of Petaluma and Ignacio Wye, about 11.9 miles to be graded, paved with Portland cement concrete and asphalt concrete on crusher run base, and bridges to be constructed across San Antonio and Novato Creeks. District IV, Route 1, Sections C,A. Macco Construction Co., Clearwater, $1,593,962; Chas. L. Harney and Piombo Bros. & Co., San Francisco, $1,598,022; E. W. Elliott Construction Co., San Francisco, $1,666,771; Parish Bros., Benicia, $1,674,228; Frederickson & Watson Construction Co., Oakland, $1,810,217; Guy F. Atkinson Company, South San Francisco, $1,894,607; M.J.B. Construction Co., and Bressi & Bevanda Constructors, Inc., Stockton, $1,896,032; Hubert H. Everist, Sr., San Francisco, $2,115,357; A. Teichert & Son, Inc., Sacramento, $2,146,267. Contract awarded to A. G. Raisch Co. and Harms Bros., San Francisco, $1,555,096.

MONTEREY COUNTY—Between Santa Rita and 0.8 mile north of Crazy Horse Summit, about 8.4 miles to be graded, crusher run base and plant-mixed surfacing to be placed, and seal coat to be applied. District V, Route 2, Section J. Frederickson & Watson Construction Co., Oakland, $872,979; Harms Bros., Sacramento, $879,896; Chas. L. Harney & Piombo Bros. & Co., San Francisco, $886,782; Macco Construction Co., Clearwater, $926,822; Guerin Bros., South San Francisco, $947,561; Guy F. Atkinson Company, South San Francisco, $977,048. Contract awarded to A. Teichert & Son, Inc., Sacramento, $795,692.

SACRAMENTO COUNTY—Across Sacramento River at Rio Vista, portion of a bridge to be removed. District X, Route 53, Section C. J. D. Proctor, Inc., Richmond, $19,647; da Roza & Billeter, Stockton, $12,275; Ocean Constructors, San Francisco, $20,030; Howard F. Lauritzen, Pittsburg, $20,989; Lord & Bishop, Sacramento, $21,000; George Pollock Co., Sacramento, $11,313; M. A. Jenkins, Sacramento, $21,363. Contract awarded to Kiss Crane Co., San Pablo, $9,450.

SOLANO COUNTY—Between Midway and 2 miles north of Dixon, about 6.1 miles to be graded and paved with Portland cement concrete, and bridges to be constructed across Sweeney Creek & McCune Creek. District X, Route 7, Sections D, I. A. Teichert & Son, Inc., Sacramento, $1,038,938; Frederickson & Watson Construction Co., Oakland, $1,123,607; Harms Bros., Sacramento, $1,173,529; M.J.B. Construction Co. and Bressi & Bevanda Constructors, Inc., Stockton, $1,196,942; Parish Bros., Benicia, $1,198,869. Contract awarded to Frederickson Bros., Emeryville, $1,035,012.

HIGHWAYS OF CALIFORNIA

(Continued from page 19)



Typical section of Arroyo Seco Parkway between Los Angeles and Pasadena

Legislature stipulated that the revenue from two and one-fourth cents of the gasoline tax be used for improvement to State routes through cities and to other streets of major importance and it became permissible to expend State highway funds anywhere on the State System in either rural or urban areas.

This shifting of responsibility to higher levels of government was not confined to California, or even to the States. The U. S. Bureau of Public Roads (now the Public Roads Administration) began a change in its rules and regulations by granting certain Federal Aid to urban projects. Recognition of these changing conceptions reached a new high at the Federal level with Congressional inclusion in the Federal Aid Act of 1944 of specific appropriation for urban Federal Aid improvement.

Traffic studies by the California Division of Highways made 12 and more years ago clearly indicated that, if the State Highway System was to approach the fulfillment of its purpose, adequate provisions would have to be made for the ever increasing volumes of traffic feeding to and from or through metropolitan areas.

Besides the legislative changes permitting expenditures of State funds on urban extensions of State routes the most important implement toward provision of needed traffic facilities was the passage of 1939 of statutory provisions recognizing the "Freeway Principle" and providing the Highway Commission with the power to designate routes as freeways and to acquire the access rights of abutting property owners to such highways.

During the period of conversion from the old idea of rural State roads to the conception of a completely integrated system of urban and rural highways, the Division of Highways was laying plans for the provision of express-ways which would enable urban traffic to cut through the snarled congestion of cars feeding into metropolitan centers.

The first true freeway construction undertaken and completed on the State Highway System was that of the Arroyo Seco Parkway connecting Pasadena with downtown Los Angeles.

Ground was broken in South Pasadena on March 22, 1938, for the first Arroyo Seco contract and on December 30, 1940, the six-lanes of the nine-mile divided parkway were dedicated and opened to travel.

Construction was so designed, that even though the terrain of the Arroyo did not permit the building of conventional clover leaf interchanges, com-



Cahuenga Freeway will be carried into downtown Los Angeles to Aliso Street Bridge

pressed ramp types were used which eliminated left-hand turning for traffic entering or leaving the parkway. Accelerating and decelerating lanes were likewise provided. Elimination of cross-traffic was accomplished by overhead structures. The grade separation features required construction of 22 vehicular bridges, two pedestrian structures and two railroad bridges.

Of the five and three-quarters million dollars cost of that portion of the Arroyo Seco Parkway between Pasadena and the Los Angeles River, over one-and-a-half million dollars was expended for bridges. Construction of the paved Arroyo Seco flood control channel by the City of Los Angeles and the Federal government cost an additional $6,400,000.

Financing of the parkway was accomplished by cooperation between the State, cities of Los Angeles, Pasadena and South Pasadena, Federal Public Roads Administration, PWA and WPA.

The details of construction for other freeway projects in the Los Angeles area are similar to the story of the Arroyo Seco Parkway. The total development of these expressways will require some time, but it is planned that by the next three or four years the comprehensive plan for this metropolitan area will have reached a stage of completion which will serve traffic with some degree of adequacy.

The extension of the Arroyo Seco Parkway through Elysian Park has been completed to Adobe Street. A portion of the Cahuenga Freeway has long been in service from Highland Avenue in Hollywood toward the San Fernando Valley. The Ramona Freeway which carries traffic easterly from the Aliso Street Bridge in downtown Los Angeles to Pomona, San Bernardino and Riverside, while not constructed to the standards of limited access used for the Arroyo Seco and Cahuenga Pass freeways, has been partially developed as an interurban arterial. The Olympic Freeway which will eventually serve as an expressway between the heart of Los Angeles and Santa Monica is being progressively completed to freeway standards by the City of Los Angeles with the financial cooperation of the State.

Plans are now complete for carrying the Cahuenga Freeway parallel to Sunset Boulevard into downtown Los Angeles to the Aliso Street Bridge. This expressway will be known as the Hollywood Parkway.

SANTA ANA FREEWAY

In addition to these five freeways feeding into the central Los Angeles metropolitan area there will be the Santa Ana Freeway which will carry U. S. 101 from the Aliso Street Bridge to Santa Ana and the Harbor Freeway which will extend southerly from the Arroyo Seco Parkway and parallel to south Figueroa Street to the Los Angeles Harbor.

In San Diego, construction is now beginning on development of the Balboa Parkway which will lead out of the city to the north through Balboa Park to a connection with the inland route to Riverside.



East Shore Freeway which will be extended to San Jose. This section is between Richmond and San Francisco-Oakland Bay Bridge

In the north, due to the phenomenal growth of traffic in the San Francisco peninsula area, it is imperative that the Bayshore Highway between that city and San Jose be converted as soon as possible into a six- and, in some instances, eight-lane freeway. This work was on the California Highway Commission's agenda in 1940 but was shelved after Pearl Harbor.

Since the first section of the Bayshore was opened to traffic in 1924, it has developed into one of the most important main-trunk highways in the State for through traffic to and from the southerly sections of the State, but particularly for the ever-increasing volume of express commuter-type of traffic between San Francisco and the residential urban areas on the peninsula. As the volume of traffic mounted, so did the accident rate until, compared with other four-lane highways in the State, it ranks among the highest in accidents per vehicle-mile.

Such undertakings as the original Bayshore Highway and its proposed conversion to a freeway, involving as they do expenditure of very large sums of highway funds, necessarily must be built under long-range programs.

Three units of the Bayshore Freeway are scheduled: (1) surveys, plans, and right of way acquisition from the Bay Bridge ramp at Fifth Street in San Francisco to the south city limits, 5.2 miles; (2) six lanes in width from the north city limits of South San Francisco to 0.3 miles south of the Southern Pacific underpass, 2.0 miles; and (3) six lanes in width between 0.3 miles south of the Southern Pacific Underpass to Peninsula Underpass in San Mateo, 6.6 miles. What might be termed a fourth unit is now under construction, a four-lane freeway on new alignment connecting the present southerly terminus of the Bayshore Highway at Santa Clara Avenue in San Jose with U. S. 101 at Ford Road, 8.1 miles to the south.

Another development of the freeway type delayed by the war was the East Shore Freeway between Richmond and San Jose. As early as 1940 the Highway Commission had planned to launch construction of the first unit in the 1941-43 budget, and more than a million dollars had been spent jointly by the State and the City of Oakland in the purchase of right of way for the new freeway through Oakland.

A considerable portion of the East Shore Freeway north of the Distribution Structure was constructed in the years before the war as the northerly approach to the Bay Bridge, but south of Oakland the project is still in the planning stage. Three units, however, are listed in the current postwar programs. (1) six lanes from the South City Limits of Oakland to High Street, 2.9 miles; (2) six lanes from High Street to Sixth and Oak Streets, 3.3 miles; and (3) four lanes from the Junction of State Routes 14 and 69 through El Cerrito and Richmond, 1.9 miles.

Benefits expected to be derived by construction of the East Shore Highway are:

(1) Adequate transportation between Oakland and valley points for agriculture and industry.

(2) A suitable trade route between Oakland and San Jose.

(3) An easier route to recreational areas.

(4) Alleviation of chronic congestion through Oakland. As many as 40,000 vehicles have been clocked in a single day on four-lane E. 12th Street, the present State Highway route.

Development of these proposed parkways is included as a major part of the Division of Highways $115,000,000 postwar construction program which was launched on November 9, 1945.

Shasta Reservoir Operated for Flood Control

(Continued from page 6)

to 1,300,000 acre-feet and 80,000 second-feet, respectively.

The excessive precipitation throughout the Sacramento River Basin during the months of November and December, 1945, averaged more than 150 per cent of normal and culminated in a flood of appreciable magnitude with high river stages prevalent in the Sacramento Valley from December 22d to January 10th. The Sacramento River Flood Control Project, over which the State Division of Water Resources exercises supervision of maintenance and operation, functioned without levee failure. Little Holland Tract and Liberty and Prospect islands in lower Yolo By-pass were inundated early in the flood. However, the State has flowage easements on these areas which permit the maintenance of substandard levees of sufficient height to provide protection only against low flood flows and high tides. The peak flow of the Sacramento River at Iron Canyon was 78,000 second-feet on December 27th. Peak flows at other locations in the Sacramento Valley included 80,000 second-feet on the Sacramento River near Chico; 40,000 second-feet on Sacramento River at Colusa; 51,000 second-feet in Sutter By-pass at Long Bridge; 48,000 second-feet on Feather River near Oroville; 22,500 second-feet on Sacramento River at Knights Landing; 68,000 second-feet on Sacramento River at Verona; 38,000 second-feet on American River at Folsom; 94,000 second-feet on Sacramento River at Sacramento; and 107,000 second-feet in Yolo By-pass at Lisbon. Water spilled over Moulton, Colusa, Tisdale, Fremont and Sacramento weirs into by-pass channels, although it was not necessary to open the movable gates on the crest of Sacramento Weir. The greatest flow released into project by-passes was that of 115,000 second-feet which entered the head of Yolo By-pass over Fremont Weir on December 30th.

The State Division of Water Resources directly maintains and operates flood control works constructed primarily for the protection or benefit of the project as a whole. These units comprise levees aggregating 90 miles in length, all by-pass channels, 50 miles of collecting canals and seepage ditches, three drainage pumping plants (2,000 h.p.), all nonnavigable river channels, five major flood control weirs, including one with a movable crest—crest lengths aggregate 14,325 feet—two sets of outfall gates, and numerous minor weirs, control structures, bridges, gaging stations and recorders.

The division also maintains and operates six radio water stage transmitters at strategic locations on Sacramento River at Iron Canyon (122 miles distant from Sacramento), Sacramento River at Ord Ferry, Feather River near Oroville, North Fork American River at Rattlesnake Bridge, South Fork American River at Coloma and San Joaquin River near Vernalis for use in obtaining timely forewarning of flood flow conditions to enable the prompt dissemination of information essential to the maintenance of flood control works. Water stages at these untended gaging stations are automatically transmitted hourly to the division office at Sacramento. These transmitters are of particular value when telephone and telegraph communication may be interrupted by storm. From the information so received it is possible to forecast the stage, magnitude and time of arrival of a particular flood crest essential for the protection of the populated areas in the lowlands. Similar radio broadcasts from automatic stage transmitters on the Kaweah River at McKay Point near Visalia and Kings River at Piedra east of Fresno are also received at Sacramento, 168 miles and 203 miles, distant from Sacramento, respectively.

In Memoriam



William Henry Rockingham

THE Division of Architecture, Department of Public Works, deeply regrets the sudden death of William Henry Rockingham early of the morning of January 5, 1946, at the age of 57 years.

"Bill," as he was known to his friends and associates, was in State service for 25 years and at the time of his death held a very important key position with the division in the capacity of Principal Mechanical and Electrical Engineer having charge of a large group of mechanical, electrical, and civil engineers. His responsibilities related to the design and installation of all heating, plumbing, lighting, ventilating, refrigerating, water supply, roads, drainage, sewer, and power systems; secure site and topographic surveys; conduct rate surveys; and make and check property descriptions.

Born in Inverness, Province of Quebec, Canada, July 29, 1888, he received his early education at Fort Bragg and Elk Grove, California, attended Polytechnic College of Engineering in Oakland, and graduated from the University of California in engineering in 1915.

He is survived by his wife, Winifred G., daughters, Phyllis Jean and Mrs. Paul W. Ayres, Jr., and his granddaughter Paul Anne Ayres.

San Francisco-Oakland Bay Bridge Peak Traffic Creates Problems

(Continued from page 22)

on military leaves. The painting program has been especially retarded during the last few years and it is planned to expand operations on this phase of maintenance as soon as possible.

The financial condition of the bridge continues to be excellent, as would be expected from the large volume of traffic which uses it.

The bridge staff is exerting itself to furnish the best possible service to the public and to maintain and operate the bridge in such a manner that it will perform efficiently its function as the principal highway connection between the cities on the east and west shores of San Francisco Bay.

State of California

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DIVISION OF CONTRACTS AND RIGHTS OF WAY (LEGAL)

C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
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Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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POSTWAR PROGRESS IN CALIFORNIA

By EARL WARREN, Governor of California

THROUGHOUT the war our State Government gave priority to the victory effort. It was obvious to all of us, however, that even while the war was going on we should be preparing for the reconversion years. The Department of Public Works and other agencies of State Government were directed back in 1943, therefore, to start developing a comprehensive public works program. The purpose was to be twofold: to create jobs during the postwar period and to enable the State to catch up with the needs of its hospitals, colleges, correctional institutions and other facilities—needs that of necessity had been neglected for 15 years.

The State had been unable to finance these needed improvements during the depression years. Manpower and materials were not available during the war. Our construction needs were such that they could not be financed with normal State revenues but, fortunately, State income increased during the war to a point where this needed construction could be financed. The Legislature and I agreed that the money which came into our treasury during the months of wartime industrial and commercial activity should be used to bring State institutions up to date and to make necessary provision for rendering services to our increased population.

PROGRAM STARTED IN 1943

We started in 1943 to develop our program. It was realized that if we were to proceed with public works projects promptly following the war, plans for them had to be prepared well ahead of time.

It became possible to do this because, for the first time in the history of our State, there was instituted in the Department of Public Works a policy of having highway surveys completed, rights of way purchased, and construction plans finished in advance of construction authorization. The same policy is applicable to the Division of Architecture in the construction of State buildings.

In line with this policy, we set aside, during the 1943 Session of the Legislature, $1,500,000 for use by the Division of Highways in making surveys and preparing plans for postwar highway construction. The sum of $10,500,000 was provided for rights of way. The plans were complete when V-J Day arrived, and the State was ready to launch a $123,000,000 highway program. Construction is already well advanced. By the end of March, 1946, approximately $20,000,000 worth of rights of way had been acquired, and contracts aggregating $32,500,000 had been let.



EARL WARREN
Governor of California

In the years 1943-44 there also was appropriated $3,250,000 to finance the preparation of plans and specifications for the new buildings required by State agencies. The Division of Architecture, on V-J Day, had completed plans for $22,454,000 of these public building projects. The amount was brought to $30,000,000 by March 31st, and the division is now engaged in preparing plans for an additional $30,000,000 worth of new hospitals, correctional institutions, and other buildings. An omnibus appropriation for a total of $154,000,000 was made at the 1946 Special Session for these and other State buildings, including $31,000,000 to The Regents of the University of California, and their construction will enable our State institutions to handle the needs of our growing population up to the year 1950.

The State also extended assistance to the cities, counties and other local governmental units in planning postwar public works.

The 1943 Legislature appropriated $1,500,000 to the counties toward the cost of surveying new county roads and preparing the plans for their construction. These plans are the basis of a potential $58,000,000 construction program. At the 1945 session, $12,000,000 was allocated to the counties of the State to enable them to match $15,000,000 of Federal Aid secondary highway funds.

An appropriation of $10,000,000 was made during a special session of the Legislature in 1944 to assist the cities of the State as well as the counties and various districts in acquiring sites and preparing plans and specifications for local public works projects. At the 1946 Special Session, the Legislature appropriated $90,000,000 toward the construction of these local public works, including sewage disposal facilities, streets and highways, hospitals, detention homes, schools, flood control projects, fire protection and prevention facilities, and harbor facilities. To date, the cities and counties have applied for $3,526,574 of the plans and sites money. The projects to be based on these plans would involve an aggregate expenditure of $175,207,000.

PUBLIC WORKS PROJECTS

Figures compiled by the State Reconstruction and Reemployment Commission show that the cities, counties, and irrigation and similar districts have proposed public works projects for construction during the next three years calling for a total outlay of $630,000,000. Local agencies have $400,000,000 in cash on hand for these works, including the $90,000,000 granted to them by the Legislature.

The aggregate of these several programs—State highway and buildings, county roads, and the public works of local agencies—exceeds $950,000,000. When we include the plans of the Federal Government for water projects, and our own plans for beach and park improvements, construction of medical centers, and many other things, it will be seen that California has entered the postwar reconversion period with a truly comprehensive public works program.

Under the Water Resources Act passed by the 1945 Legislature, the State accepted financial responsibility for the local costs of water projects

which the Federal Government proposes to develop in California. On these water projects, the Federal Government expects to spend between $400,000,000 and $450,000,000. The local costs eventually will amount to $32,000,000, toward which $10,000,000 has been appropriated. The $10,000,000 will take care of all the projects which can be built during the next several years.

OTHER APPROPRIATIONS

Appropriations totaling $1,120,335 were made at the Special Session of 1946 to construct new fish hatcheries and game refuges. Construction of new facilities at our State parks and beaches was appropriated for in a total amount of $2,249,600. Two million dollars was set aside for reforestration. The first units of our new state-wide trails system will be constructed under an appropriation of $300,000 made at this session.

The omnibus appropriation bill included $31,000,000 for our university and $13,500,000 for the State colleges. In addition, bills were passed making $11,000,000 available for medical centers at the university, and $8,000,000 for dormitories to alleviate a severe shortage of student housing both at the several campuses of the university and at the State colleges. For the emergency housing of war veteran students returning to the university and State colleges, an appropriation of $250,000 was made.

Designs have been drawn for new classroom and other facilities at the San Francisco, Fresno, San Jose, San Diego, Humboldt and Chico State Colleges to supply the needs of an enrollment which will probably exceed the prewar registration by 50 per cent or more.

MEDICAL CENTERS

Of the appropriation for medical centers, $4,000,000 is for modernizing and completing that on the San Francisco campus of the university. Seven million dollars will enable us to establish a Medical Center on the campus of the University of California at Los Angeles.

The Department of Mental Hygiene was included in the omnibus appropriation for $57,500,000. With the improvements this will make possible, we expect to move California out of the "asylum age" into the "hospital age."

A contract has already been let for construction at the Stockton State Hospital in the amount of $1,383,307. This project will accommodate 1,000 patients in new and modern quarters. Contracts for the care and housing of 3,200 additional patients at Agnew, Napa, Norwalk and Camarillo State Hospitals and the Pacific Colony State Home will be let as promptly as possible, consistent with the availability of manpower and materials.

HOSPITAL IMPROVEMENTS

Plans were completed recently for psychiatric treatment groups at Camarillo and Napa to make effective a broad scale, scientific attack on the problem of mental illness. Each of these groups will accommodate 700 patients.

The construction program of the Department of Mental Hygiene includes a new hospital at Porterville exclusively for the treatment of epileptics. In the past, these unfortunates have been commingled with the insane and the mentally defective, a practice which is a relic of the dark ages.

New tubercular sanatoria have been designed by the Division of Architecture since the end of the war, providing for scientific segregation and treatment and the prevention of the spread of tuberculosis in State hospitals. These will be erected at Patton State Hospital at a cost of $1,200,000 and at Sonoma State Home at a cost of $506,000.

Plans are being drawn by the Division of Architecture for new housing to replace the obsolete quarters for the children living at the State Home for the Deaf in Berkeley. An appropriation of $2,000,000 has been made for the purpose of establishing a similar institution in Southern California.

PRISON BETTERMENTS

For the Department of Corrections, plans for a new dormitory at the Chino Institution for Men, to house 300 prisoners, have been brought to completion in accordance with the program of prison reorganization launched two years ago. Designs for industrial shops at San Quentin Prison have been prepared and at Folsom Prison similar industrial facilities have been planned for construction. The omnibus bill includes $12,200,000 for the Department of Corrections. This will finance the construction of a medical facility for 1,200 inmates, a new medium security prison for 1,600 men, and the general modernization program.

The California Youth Authority is included in the bill for $7,000,000. This will provide a new industrial school for boys in the intermediate age group. It will also modernize and complete the Los Guilucos School for Girls, and our other Youth Authority institutions. The designs for new dormitories at the Fricot School for Boys have already been completed.

VETERANS' HOME ENLARGED

To meet urgent needs at our Yountville Veterans' Home, a contract has already been awarded for improvements in the sum of $458,285. A total of $3,481,000 has been appropriated for this institution, including $2,400,000 in the omnibus bill. A domiciliary barracks for women veterans, who have not heretofore been admitted to the home, is covered by this program.

Under the Veterans Bond Act of 1944, loans are being made to California veterans at the rate of nearly $600,000 a month for the purchase of homes and farms. An additional bond issue of $100,000,000 is being submitted to the vote of the people next November. The majority of the homes will involve new construction.

Emergency housing for war veterans and their families is being provided under a $7,500,000 special session appropriation. These State funds are being distributed to cities and counties on a 90-10 matching basis to pay the local costs of rehabilitating and relocating surplus Federal housing.

REAPPRAISING HIGHWAY SYSTEM

One of the noteworthy wartime accomplishments of our Division of Highways was that, while engaged in the stupendous task of maintaining highway pavements damaged by heavy war traffic, it was able to construct $30,746,000 worth of access roads for the Federal Government and $2,270,000 of flight strips.

The 1945 Legislature created the Joint Legislative Committee on Highways, Streets and Bridges and has appropriated $120,000 for a reappraisal and scientific study of the entire State Highway System by this fact-finding body. The work delegated to this committee is highly important and necessary. We must have more roads of all kinds. We need them to expedite the transportation of our crops and factory products. Main routes must be brought to higher standards. Better access to our recreational areas must be provided. The leadership of California in highway development must be reestablished.

HIGHWAY COMMISSION REORGANIZED

The State Highway Commission was reorganized in 1943. Membership was

(Continued on page 13)

BAYSHORE FREEWAY WORK IS STARTED

By R. P. DUFFY, District Construction Engineer

WORK at a cost in excess of two and one-half million dollars has been placed under contract on the Bayshore Freeway in Santa Clara County between Santa Clara Street in San Jose and Ford Road 8.74 miles southerly thereof.

This project is the first unit to be placed under contract in District IV for a highway designed on freeway principle and will eventually extend from San Francisco to El Camino Real south of San Jose.

It will provide a route for through traffic, by-passing the congested area that now must be used through San Jose.

Four contracts have been awarded on this unit, three of which involve the construction of structures and one providing for grading and paving.

Two of the structure contracts, one for constructing a reinforced concrete bridge over Coyote Creek and an undercrossing at Coyote Road and one for constructing an undercrossing at Ford Road, were awarded to Contractor Earl W. Heple of San Jose in December, 1945 at a cost totaling more than $355,000.

The third structure contract for which bids were received on March 13, 1946, found Frederickson & Watson Construction Company of Oakland low bidder on the interchange structure at Santa Clara Street in San Jose with a bid of $379,500.

These structure contracts are being supervised by the Bridge Department of the Division of Highways and on which Associate Bridge Engineer G. W. Thompson has been assigned as Resident Engineer.

The road contract, for which bids were received on December 12, 1945, was awarded to Contractor N. M. Ball Sons of Berkeley at a cost of $1,269,000.

The project involves an entirely new location and traverses the gently sloping floor of the Santa Clara Valley except for a section, slightly less than two miles in length, in the vicinity of Coyote Creek where the line penetrates the foothills and from which source the major portion of the embankment material is obtained.

The alignment, exclusive of the Ford Road interchange, contains only three curves involving a total curvature of 72° 18′ with a minimum radius of 3,000 feet. At the Ford Road connection to El Camino Real at the south end of the project the radii are 1,500 feet.

The maximum grade rate is 2.1 per cent except for the rise over the Ford Road undercrossing where there is a short piece of 4.2 per cent grade.

The maximum elevation reached on the project is 204 feet and the minimum elevation is 98 feet.

The new construction provides a four-lane Portland cement concrete pavement with two lanes in each direction of traffic divided by a 36 foot width division strip.

The pavement design is of 8 inches uniform thickness without expansion joints but with weakened plane joints on 15-foot centers. Contact joints will have ¾ inch x 15 inches tie bolt assemblies spaced at 30 inch centers.

Rock cut being excavated and hauled to fill. Smoke in background is from burning brush in clearing operations.





Here a Terra-Cobra with caterpillar dozer pusher is excavating rocky material

This pavement is placed on an average fill of about three feet above the original ground, the top foot of which is constructed of selected material from the roadway cuts.

The right of way provided for this unit is 180 feet in width with added widths where necessary for present and future interchange structures at public road intersections. The approximate cost of this right of way is $550,000.

The road contract proposal carries unit prices on 53 items of work, some of the major items being 660,000 cubic yards of roadway excavation, 600,000 square yards of compaction of original ground, 43,000,000 station yards overhaul and 50,750 cubic yards of Portland cement concrete pavement.

The grading equipment now in use by the road contractor consists of a

(Continued on page 26)

This photograph, looking south, shows completed rough grade in side hill cut



Ground-Breaking Ceremony for Cabrillo Freeway in San Diego

By R. A. HAYLER, Senior Highway Traffic Engineer

CABRILLO Freeway, San Diego's first freeway was officially started with ground-breaking ceremonies on February 6, 1946. The California Highway Commission was represented by San Diego's member, C. Arnholt Smith, who acted as master of ceremonies.

Commissioner Smith briefly reviewed the events leading up to the construction of this milestone in San Diego's highway history and complimented various city and county officials who, by their cooperation, have helped to make this dream of many years a reality.

Brief speeches were made by Donald Hanson, of the Highway Committee of the San Diego Chamber of Commerce, David Bird, Chairman of the Board of Supervisors, and Mayor Harley E. Knox. Mayor Knox officiated in turning the first shovelful of dirt at the ceremony and his efforts were contrasted to the work of three tractors and bulldozers a few minutes later, which began the actual construction of the project.

While Highway Commissioner C. Arnholt Smith (right) looks on, Mayor Harley Knox of San Diego breaks ground for the new Cabrillo Freeway



E. E. Wallace, District Engineer of District XI, was introduced by Commissioner Smith and gave a brief resume of the project. Preliminary plans were begun in 1938 on this freeway which connects downtown San Diego with the residential sections, and also serves as a more direct connection for US 395, the Inland Highway leading to Riverside and San Bernardino. In March, 1941, the people of San Diego voted eight to one to set aside a 200-foot width of right of way through Balboa Park for highway purposes. With this fine start, plans were rapidly taking shape when the beginning of the war put a temporary stop to this work.

From 1942 to 1944 the project was at various times considered as a possible access road, connecting various military establishments in the vicinity of San Diego but was finally set aside for other access roads which were considered more necessary. In 1944 the freeway was included as Postwar Project No. 116 in the State's Postwar Program of construction. Plans were completed in 1945 and at the close of the war preparations were made for advertising various units of this freeway at an early date.

CONTRACTS AWARDED

At the present time two bridge contracts have been awarded: one for overhead structures at Date, Quince and Upas streets in Balboa Park to M. H. Golden Construction Company, and the other for a bridge across the San Diego River, to Harry L. Foster.

The first unit of the roadway contracts, covering construction from A Street to 0.4 miles south of Mission Valley, was awarded to Mittry Brothers on a bid of $1,338,000. This involves 2.9 miles of grading and paving with Portland cement concrete. The typical section through Balboa Park will be a four-lane divided highway with 36-foot center dividing strip, planted with trees and shrubs. Included in the roadway contract is a



Cabrillo Freeway traverses the Eleventh Avenue Canyon through Balboa Park. This view is looking north from Laurel Street Bridge

Beginning grading operations on Cabrillo Freeway. Looking north from Washington Street toward Mission Valley





Cabrillo Bridge in Balboa Park which will span new Cabrillo Freeway

complete sprinkler system which has been installed in order to aid in the landscaping and roadside treatment which will be done by the State to blend the roadway with its natural surroundings.

As most of the freeway follows a natural drainage channel, it will be necessary to construct a storm drain system with pipes ranging in size from 24 inches to 60 inches in diameter.

The State is represented on this first roadway contract by J. Frank Jorgensen, as Resident Engineer.

The second unit of roadway construction is from 0.4 miles south of Mission Valley to 0.4 miles north of San Diego's North City Limits. It is estimated that the entire project will be completed late in 1947. A total of 10 grade separation structures, included in the present construction, together with existing Robinson Avenue and Washington Street Bridges previously constructed by the State, will give a continuous roadway from Eleventh and Ash Streets, San Diego, to Kearney Mesa, free of intersecting traffic.

TOTAL COST

The total cost of the entire project of seven miles of Freeway, will be approximately $4,000,000 including landscaping work. Over 1,650,000 cubic yards of dirt will be moved, involving approximately 30,000,000 station yards of overhaul. The project is financed from gas tax funds appropriated by the California Highway Commission, together with $500,000 supplied from one-fourth cent gas tax funds for State highways through cities, and matched with Federal funds for postwar highwar construction.

The improvement when completed will provide a much-needed arterial for U. S. Highway 395 on parkway standards, connecting the business section of San Diego with the inland communities to the north.

Service Charge on Bay Bridge Reduces Traffic Halts 51%

DURING the first 45 days, February 15th to March 31st, of the imposition of a $5 service charge for refueling automobiles stalled on the San Francisco-Oakland Bay Bridge for lack of gasoline, traffic stoppages on the span due to such causes were reduced approximately 51 per cent, according to Director of Public Works C. H. Purcell.

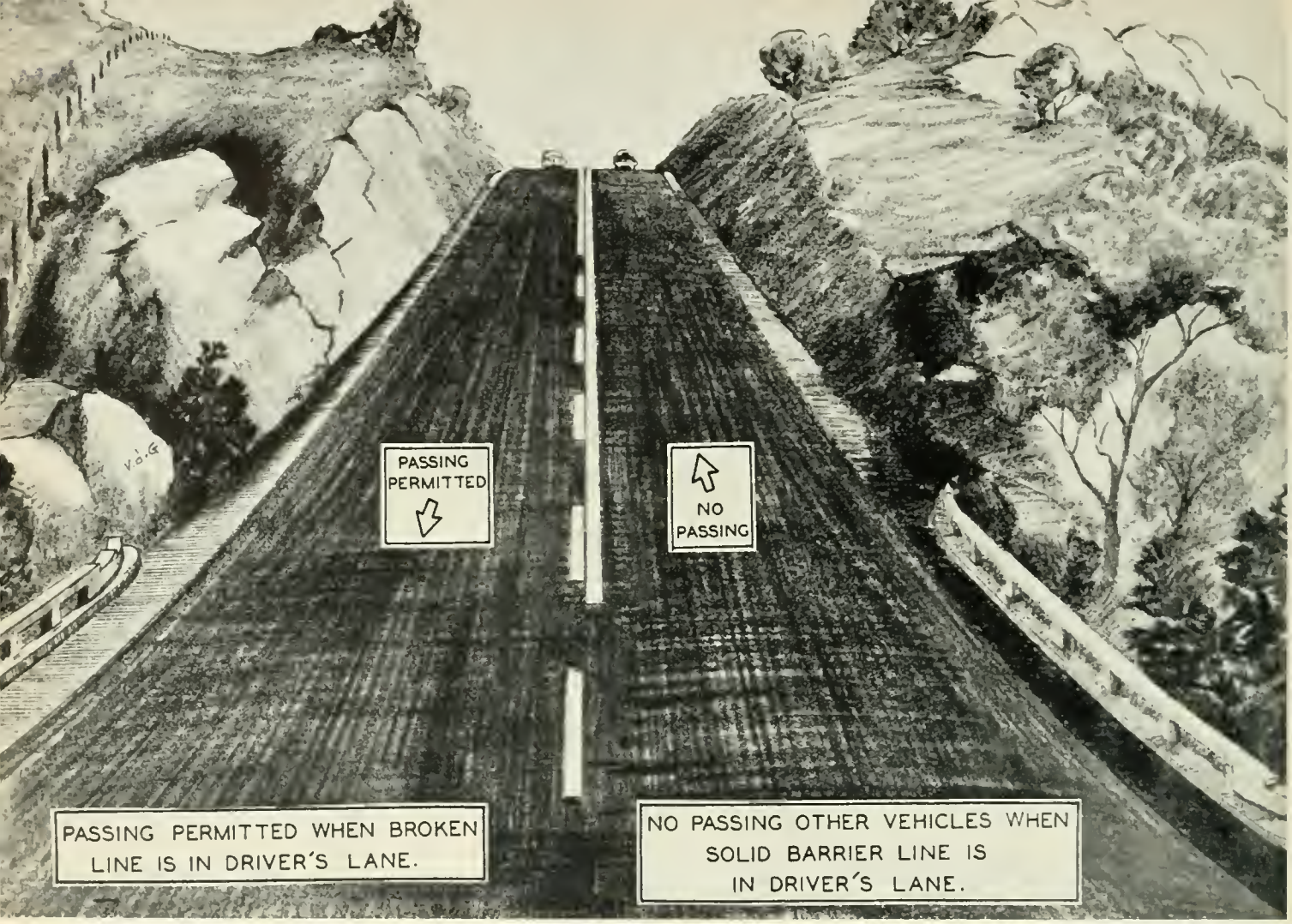
From January 1st to February 14th, inclusive, a 45-day period during which the new regulation was not in effect, there were 506 vehicles stalled on the bridge because of lack of gasoline.

Beginning February 15th and ending March 31st, a 45-day period there were 247 stalled cars, a reduction of 51 per cent.

During the period January 1st to February 14th, an average of 11.24 vehicles per day ran out of gas, in each case halting traffic. During the ensuing 45 days, February 15th to March 31st, 5.49 vehicles per day were stalled for lack of fuel.

"These figures," Purcell said, "are impressive when it is considered that numerous rear-end collisions and other accidents are caused by stalled cars. In view of the large decrease in the number of traffic stoppages occasioned by fuelless motor vehicles on the bridge, the imposition of a $5 service charge appears to be fully justified. The Department of Public Works appreciates the cooperation it is receiving from motorists."

Motorists whose automobiles stop on the bridge for lack of gas are charged 20 cents per gallon for a maximum of three gallons of gasoline in addition to the service charge.



YELLOW "NO PASSING" LINE DOOMED

THE yellow "No Passing" traffic line so familiar to California motorists traveling over State highways is on its way out. Director of Public Works C. H. Purcell, pursuant to authority vested in the Department of Public Works by law and in conformity with the Federal Aid Highway Act of 1944 designed to effect, among other things, a uniform National system of highway signs and traffic control devices, has executed the required legal order to the Division of Highways calling for the immediate marking of "No Passing" zones with two continuous or solid parallel white lines where overtaking and passing slower moving vehicles is prohibited, and a combination solid and broken white line when passing is restricted to one direction for vehicles approaching a blind crest of grade.

A solid white or barrier line on the right of the broken line and in the driver's lane will indicate "No Passing."

A driver may overtake and pass a slower moving vehicle if the broken line is in the driver's lane, providing the way ahead is clear.

The California Vehicle Code provides for a distinctive pavement marking for "No Passing" zones. These zones are designated where either the volume of traffic or the vertical or horizontal curvature of the roadway renders it hazardous to attempt to drive to the left of such markings.

"It will require several months" Purcell said, "to change the markings at all 'No Passing' zones and eliminate the yellow line now used to indicate 'No Passing.' There will be a transition period during which both the present and new type of markings will be in place and must legally be observed."

Report on Progress and Records in Pavement Construction During 1945

By EARL WITHYCOMBE, Assistant Construction Engineer

THE year 1945 marks the smallest mileage of high type pavement constructed by the Division of Highways since 1924. Out of a total of 127.3 miles of highway construction, only 11.5 miles were built of portland cement concrete or asphalt concrete.

The total mileage of Federal access road construction was also greatly reduced in 1945. The entire program totaled 51.0 miles, of which 7.4 miles was high type pavement, and the remainder was low type bituminous construction.

The expenditure of State funds went almost exclusively to finance the repair of existing pavements with low type bituminous surfaces. Some 416.4 miles of this work were constructed, of which 337.5 miles were plant-mixed and 4.7 miles were armor coat, the remainder being road-mixed bituminous construction. Increasing amounts of cushion courses were used to cover concrete pavements which are subject to rocking and pumping action.

The performance of thin bituminous blankets laid in the past directly on such pavements has demonstrated the need of an insulating course between the bituminous blanket and the moving foundation. Selected rocky granular material, crushed rock and crusher run are used for these cushion courses and are generally six inches thick. This type of construction has been under traffic in heavily traveled sections for a period of three years, and in no instance has the result of the rocking slabs been transferred through the cushion course sufficiently to crack the bituminous surface.

Portland Cement Concrete

Information gained from the study of California pavements now in progress under the supervision of the Materials and Research Department, and from experience with experimental sections installed in this and other States, has led the department to make a radical departure from the conventional design of concrete pavements. In the future expansion joints will be eliminated entirely except for the junction of pavement and bridge end. The practice of construction in single lane widths will be continued, and the longitudinal joint will be provided with load transfer by means of tongue and groove with tie bolts at 30-inch intervals. This same construction type will be used at transverse contact joints. To facilitate installation in the separate slabs, the tie bolts will be joined together along the joint face by means of threaded couplers imbedded in the first strip poured. Transverse weakened plane joints will be installed at 15-foot intervals. The slab will be of uniform thickness with an 8-inch minimum depth, and the concrete will carry five sacks of cement to the cubic yard.

During 1945 the design adopted in 1942, which consisted of eliminating steel and dowels, and by thickening slab at expansion joints, for war construction, was used, except that the largest project for the season, in San Diego County, was constructed without expansion joints.

The principal portland cement concrete pavement laid during 1945 was in San Diego County, being a 4.5-mile access project between Palm Avenue and Coronado, Contract 11AXC4-P. Basich Bros. were the contractors, H. F. Caton, resident engineer, and W. Cattell, the street assistant. This contract had the **highest average daily output** of concrete during the year, 371.7 cubic yards per 8-hour day, the **highest average compressive strength** of concrete, 4,428 pounds per square inch, and the **smoothest riding quality** of surface with an average roughness index of 7.2 inches per mile.

There were three other small concrete projects completed during the year, totaling 1.7 miles. The average daily concrete output for the State in 1945 was 236.1 cubic yards, as compared to 425.8 cubic yards in 1944. The average strength of 28-day breaks was 4101 pounds per square inch in 1945, compared to 3876 pounds in 1944. The average surface smoothness for concrete pavement was 14.2 inches per mile in 1945 compared to 10.1 inches in 1944.

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1945

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per day	Average strength, 28 days, lbs. per sq. inch	Roughness index, inches per mile
Marin, Entrance to Hamilton Field	A. G. Raisch Co.	W. A. Rice	D. N. Sapp	146.2	3991	27.3
Alameda, University Ave.-El Cerrito Hill Overhead, Berkeley, Albany	Lee J. Immel	F. W. Montell	L. G. Marshall	119.6	3245	17.7
San Diego, Palm Ave.-Coronado (por.)	Basich Bros. Const. Co.	H. F. Caton	W. Cattell	371.7	4428	7.2
San Diego, Pacific Highway-Washington St.	Ralph O. Dixson	J. F. Jorgensen	G. S. Kibby	172.3	3713	42.7
			Averages	236.1	4101	14.2



Two 23-foot lanes of Portland cement concrete pavement on Douglass Street extension in San Diego

Asphalt Concrete

The total mileage of asphalt concrete pavements constructed during 1945 was but 4.7 miles, spread over seven short sections from 0.2 mile to 1.4 miles in length. All of the 1945 construction was laid by means of self-propelled finishing machines of the type not requiring the use of side forms.

An experimental section 0.7 mile in length was laid on Contract 5VC4, Zaca to Pismo Beach, over rocking concrete slabs, using a 2-inch course of open-graded mix similar to the old binder course formerly used under sheet asphalt pavement, and topped with a 2-inch course of asphalt concrete. Asphalt with a penetration of 85 to 100 was used in both courses. It was thought that this construction might prevent cracking and spalling of the surface course from foundation movement.

The **highest average daily output** of asphalt concrete during 1945 was on Contract 10ANC10, Tennessee and Georgia Streets in Vallejo, where an average of 666.6 tons per 8-hour day were laid by Sheldon Oil Company, contractor, G. R. Hubbard, resident engineer, and G. R. Barry, street assistant. The average daily output for

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1945

Location	Contractor	Resident Engineer	Street Assistant	Average tons laid per day	Average stability of surf. mix in %	Roughness index, inches per mile
Marin, Entrance to Hamilton Field	A. G. Raisch Co.	W. A. Rice	D. N. Sapp	295.8	48	50.0
San Mateo, San Bruno, Sneath Lane-Forest Lane	Union Paving Co.	W. G. Remington	E. J. Carter	359.2	51	22.2
Alameda, University Ave.-El Cerrito Hill Overhead, Berkeley, Albany	Lee J. Immel	F. W. Montell	W. Hegy	490.2	30	15.0
Alameda, Contra Costa-El Cerrito Hill Overhead-Rte. 14, Albany, Richmond	Louis Biasotti & Son	G. L. Beckwith	C. Hamma	243.9	39	14.5
Santa Barbara, San Luis Obispo-Zaca-Pismo Beach	Brown, Doko & Baun	J. C. Adams	M. Chapman	298.7	43	20.2
Solano, Tennessee and Georgia Sts., Vallejo-Route 7	Sheldon Oil Co.	G. R. Hubbard	G. R. Barry	666.6	35	42.2
San Diego, Pacific Highway-Washington St.	Ralph O. Dixson	J. F. Jorgensen	M. C. Barron	200.0	47	41.7
			Averages	341.2	39	24.7

the State was 341.2 tons, compared to 392 tons in 1944.

The **highest stability of surface mixture** was obtained on Contract 4ATC3, Sneath Lane to Forest Lane, with an average of 51 per cent. Union Paving Company was the contractor, W. G. Remington, resident engineer, and C. W. Snyder, plant assistant. The State average was 39 per cent, compared to 12.8 per cent in 1944.

The record for **surface smoothness** was made on Contract 4WMC5, El Cerrito Overhead to Route 14, with an **average roughness index** of 14.5 inches per mile. Louis Biasotti and Son were contractors, G. L. Beckwith, resident engineer, and C. Hamma, street assistant. The average for the State was 24.7 inches, as compared to 18.2 inches in 1944.

Bituminous Treated Surfaces

A total of 416.4 miles of this type of construction was laid in 1945, of which 411.7 miles was the mixed type and 4.7 miles, armor coat. Of the mixed type, only 18 per cent was constructed by the road-mixed method, and 82 per cent was mixed through a plant.

Of the 337.5 miles of plant-mixed bituminous surfacing laid in 1945, 28.5 per cent was constructed with open-graded mix. This mix is somewhat new to the Division of Highways, although it has been used by other road-building agencies in California for some years. It consists of practically the same grading of coarse aggregate as the dense-graded mixtures, with the material finer than the No. 8 sieve reduced to a negligible amount. The amount of asphalt is approximately the same in both mixes. The cost of producing aggregate for the open-graded mix is somewhat greater than for the dense-graded mixture, but the bids for open-graded mix in 1945 averaged only 110 per cent of the average cost for dense-graded mix.

The 1945 record for **smoothness of riding surface on plant-mixed surfacing** was shared by two projects: Contract 7KC5, Carmenita Road to Orangethorpe Avenue, Griffith Company, contractor, C. P. Montgomery, resident engineer; and Contract 9VC2, Mojave to Cinco, Oilfields Trucking Company, contractor, R. F. Johnson, resident engineer; each contract having an average of 9.7 inches per mile. The average for the State was 19.5 inches per mile, compared to 16.8 in 1944.

The record for **smoothness of riding surface on road-mixed surfacing** was obtained on Contract 8ASC5, 2.5 miles north of Victorville to Victorville Airport, Basich Bros. Construction Company, contractor, E. A. Bannister, resident engineer, with 17.4 inches per mile. The average for the State in 1945 was 31.2 inches per mile, as compared to 32.9 inches in 1944.

The record for **armor coat surfaces** was made on Contract 1TC9, Longvale to Laytonville, A. R. McEwen, contractor, E. F. Richardson, resident engineer, with an average of 37.8 inches per mile. The State average in 1945 was 70.4 inches per mile, as compared to 48.3 inches in 1944.

Two 21-foot lanes of asphalt concrete pavement on U. S. 40 in Alameda County, near El Cerrito Overhead



BITUMINOUS TREATED SURFACES—RECORDS FOR 1945

PLANT-MIX

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
Lassen, Horse Lake Road-Madeline	A. A. Tieslau & Harms Bros.	F. S. Saunders	19.6
Shasta, Girvan-Hospital Road	State Forces	A. A. Bigelow	15.5
Placer, Roseville-Lincoln	R. A. Westbrook	E. L. Miller	19.6
Placer, Auburn-Bear River	R. A. Westbrook	E. L. Miller	38.4
Sacramento-Yolo, North Sacto.-2 Mi. E., 1 Mi. E. of Davis-Swingle	A. Teichert & Co.	H. A. Towne	17.4
Yuba-Sutter, Morrison Crossing-Linda Corner, Yuba City-Lomo, Sutter Bypass-Tudor Road	Lester L. Rice	F. D. Hillebrand	17.9
Yolo, Davis Wye-Willow Slough, Cache Creek-3 Mi. N., Woodland-1.3 Mi. N.	N. M. Ball Sons	E. Hay	13.4
Nevada, Truckee-Farad	Harms Bros.	E. L. Miller	17.6
Glenn, Oak St., Willows-Orland	E. B. Bishop	A. C. Irish	27.9
Sacramento, Isleton-Sacramento	Sheldon Oil Co.	A. C. Irish	47.9
Yolo, Rte. 99, 0.5 Mi. S.-2.25 Mi. N. of Arcade Station, Rte. 6, Yolo Causeway-1 Mi. W. of Washington Underpass	A. Teichert & Co.	H. A. Towne	25.3
Placer-Nevada, Gold Run-Kingvale	Clements & Co.	H. A. Towne	23.0
Yolo-Colusa, Bretona-Genevra	N. M. Ball Sons	E. Hay	25.8
Colusa, Williams-2.8 Mi. East	Harms Bros.	E. L. Miller	20.1
Yuba, Wheatland-Morrison Crossing	Lester L. Rice	F. D. Hillebrand	14.4
Alameda, Oakland Airport, Maitland Drive-Earhart Road, Aux. Naval Air Station	Frederickson & Watson Const. Co.	F. W. Montell	21.1
Contra Costa, Concord-Ohmer	Lee J. Immel	G. L. Beckwith	14.9
Alameda, Mission San Jose-Warm Springs	A. S. Jones	J. H. Creed	35.1
Santa Clara, Gilroy-4 Miles southerly	Granite Construction Co.	J. H. Creed	29.1
Alameda, Warm Springs-Centerville	A. S. Jones	A. Walsh	21.2
Contra Costa, Brentwood-4 Miles southeasterly	Frederickson Bros.	H. H. Deardorff	27.4
Sonoma, Beltane-Aqua Caliente	Louis Biasotti & Son	H. A. Simard	30.3
Santa Clara, Four sections on Rtes. 5, 42 and 114	A. J. Raisch Co.	W. G. Remington	20.9
Alameda, S. J. Co. Line-Livermore, and Niles-Sunol	Clements & Co.	E. Carlstad	53.7
Napa-Sonoma, Rte. 49, Napa-Oakville, Rte. 51, Santa Rosa-Beltane	A. A. Tieslau & Son	H. A. Simard	23.6
Monterey, San Ardo-King City	A. Teichert & Co.	J. C. Adams	15.7
Santa Barbara-San Luis Obispo, Zaca-Pismo Beach	Brown, Doko & Baun	J. C. Adams	13.0
San Luis Obispo, 0.8 Mi. West of Pennington Cr.-Rte. 125	Brown, Doko & Baun	V. E. Pearson	13.4
Monterey, 2 Mi. East of Monterey-El Toro	Granite Construction Co.	G. H. Hamlin	21.0
San Luis Obispo, Various locations on Rtes. 2 and 33	Granite Construction Co.	V. E. Pearson	19.4
Madera, 6.7 Mi. N. of Madera-Merced Co. Line	W. C. Railing	R. Windele	10.0
Tulare, Quail Station-6.5 Mi. N. of Goshen	Brown, Doko & Baun	C. F. Oliphant	20.5
Kern, 1.2 Mi. S. of Famosa-1.0 Mi. N. of Famosa	Griffith Company	J. W. Cole	13.5
Tulare, 6.5 Mi.-9.5 Mi. N. of Goshen	Brown, Doko & Baun	C. F. Oliphant	20.6
Kern, 14.8 Mi.-17.8 Mi. E. of Maricopa, and 2.8 Mi.-3.8 Mi. N. of Rte. 140	Griffith Company	J. W. Cole	10.5
Kings-Tulare, Hanford-Route 4	Brown, Doko & Baun	C. F. Oliphant	11.0
Orange, At Irvine, Rte. 2, on Central Ave., and Central Ave.-Marine Base	Lewis Construction Co.	C. L. Gildersleeve	17.7
Los Angeles, El Segundo Blvd., Main St.-Sepulveda Blvd.	Vido Kovacevich Co.	W. D. Eaton	18.1
Los Angeles, Latigo Canyon-1 Mi. W. of Malibu Cr.	Schroeder & Co.	G. H. Lamb	16.5
Ventura, 0.6 Mi. N.W. of Hueneme Road-Callequas Creek	Griffith Company	C. P. Montgomery	12.2
Ventura, City of Ventura-Ojai	Oswald Bros.	C. P. Montgomery	14.8
Los Angeles-Orange, Carmenita Road-Orangethorpe Ave.	Griffith Company	C. P. Montgomery	9.7
San Bernardino, Tippecanoe Ave., 3d St.-Base Line Rd.	George Herz & Co.	E. A. Bannister	26.4
San Bernardino, California Institution for Men at Chino	George Herz & Co.	I. M. Hollister	17.4
San Bernardino, Barstow-Field	Schroeder & Co.	B. Nelson	13.8
Riverside-San Bernardino, Riverside-Colton	George Herz & Co.	J. M. Hollister	13.3
San Bernardino, Daggett-Hector	Tanner Construction Co.	E. A. Bannister	21.8
Kern, Rte. 23-8 Mi. East of Inyokern Airport	Lewis Construction Co.	R. F. Johnson	18.9
Kern, Mojave-Cinco	Oilfields Trucking Co.	R. F. Johnson	9.7
Inyo, Fish Creek-Bishop	Basich Bros. Construction Co.	A. T. Moore	17.6
San Joaquin, Stockton-Rough and Ready Island	George French, Jr.	R. K. Wells	16.9
San Joaquin, Rte. 5, 2.5 Mi. E. of Tracy-2.0 Mi. southerly	Louis Biasotti & Son	R. K. Wells	24.8
Stanislaus, Franklyn St., Modesto-Stone Ave.	M. J. Ruddy & Son	E. L. Craun	18.3
Merced, 1.7 Mi. E. of San Luis Cr.-Los Banos, 1.7 Mi. N. of Romero School-Los Banos	Louis Biasotti & Son	E. L. Craun	14.6
San Joaquin, Stanislaus River-Manteca	A. Teichert & Co.	G. R. Hubbard	26.1
San Diego, Bay Blvd., bet. I St., Chula Vista, and Harbor Drive at 7th St., National City	Basich Bros. Construction Co.	R. C. Payne	33.6
San Diego, Orange Ave., 4th St.-1st St.	V. R. Dennis Co.	W. T. Rhodes	27.1
San Diego, Broadway-Torrey Pines Grade, Rosecrans St., Lytton St.-Canon St.	Griffith Company	W. T. Rhodes	13.2
San Diego, N.C.L. Chula Vista-S. Limits National City	R. E. Hazard Co.	M. C. Barron	21.1
		Average	19.5

ROAD MIX

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
Colusa, Yolo Co. Line-Grimes	R. A. Westbrook	F. D. Hillebrand	75.6
Kern, Lost Hills-Wasco	Oilfields Trucking Co.	J. W. Cole	47.4
San Bernardino, 2.5 Mi. N. of Victorville-Victorville Airfield	Basich Bros. Construction Co.	E. A. Bannister	17.4
Kern, Rte. 145 near Rademacher-Inyokern-Trona Road	Arthur A. Johnson	R. F. Johnson	35.6
Kern, San Bernardino Co. Line-1.5 Mi. N. of Inyokern	Clyde W. Wood	R. F. Johnson	40.0
Inyo, Beatty Road-East Boundary Death Valley National Monument	A. S. Vinnell Co.	D. J. Bouch	34.0
Inyo-Mono, Alabama Gates-Whiskey Canyon	A. S. Vinnell Co.	A. T. Moore	26.6
Imperial, S. Gate Seeley Airport-Rte. 12, Route 187-Holtville Airport	Arthur A. Johnson	R. C. Payne	33.6
Imperial, Rte. 26 N. of Calexico-Calipatria	Norman I. Fadel	R. C. Payne	23.0
Riverside, Imperial Co. Line-5.9 Mi. N. of Route 64	Arthur A. Johnson	M. C. Barron	21.9
Riverside, Desert Center-Black Butte	R. R. Hensler	M. C. Barron	29.5
		Average	31.2

ARMOR COAT

Mendocino, Longvale-Laytonville	A. R. McEwen	E. F. Richardson	37.8
Napa, Veteran's Home, Yountville	Lee J. Immel	E. Carlstad	123.9
		Average	70.5



This photograph shows a plant-mix surface repair project north of Buellton in Santa Barbara County

POSTWAR PROGRESS IN CALIFORNIA

(Continued from page 2)

increased from five to seven. Appointments are now made for overlapping terms, so that there will be continuity of policy in the future. The Director of Public Works became an ex officio member of the commission and its chairman. This plan was approved by the Legislature, and the State of California was fortunate to obtain the services of Mr. Charles H. Purcell as Director.

Motorists who use the San Francisco-Oakland Bay Bridge are participating in a $5,000,000 saving which will result from refinancing of the original bond issue for this project. The interest rate on these bonds was reduced from 4 per cent to 1.9 per cent. The California Toll Bridge Authority has also paid off the bonded indebtedness of the Carquinez and Antioch Bridges, and these spans are now toll free.

Public works projects are not the solution of unemployment problems. They are, however, an important factor in any program to develop jobs. State Government may well be proud of the progress that has been made in its highway construction and public building programs and of its record of assistance to other agencies in a position to make similar plans which will produce jobs.

CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

San Jose de Guadalupe
June 11, 1797

IN the heart of almost unknown land east of San Francisco Bay inhabited by treacherous Indians, Mission San Jose de Guadalupe was established on Trinity Sunday, June 11, 1797, and dedicated to the foster-father of Christ, San Jose.

It will be recalled that in November, 1794, the padres of Mission Santa Clara petitioned the commandante at the presidio of San Francisco for permission to go into this country in search of converts. Their request was refused on the ground that the natives were perverse and the adventure too hazardous.

However, on November 15, 1795, Ensign Hermenegildo Sal set out from Monterey with a detail of leather-jacket soldiers and accompanied by Fr. Antonio Danti to locate sites for missionary stations between Mission San Carlos and Mission Santa Clara and between Santa Clara and San Francisco. On the 17th they fixed upon a spot for Mission San Juan Bautista and then proceeded to Santa Clara where they were joined by Ensign Raimundo Carrillo.

On November 22d, they passed Alameda Creek, which Fr. Danti named Arroyo de San Clemente, and went to a point east of San Francisco Bay where, from an elevation, they could see Mission Dolores in San Francisco and Yerba Buena Island in mid-bay. Here Fr. Danti set up a cross on the elevation which he called San Francisco Solano.

NEW MISSION APPROVED

Fr. Fermin Francisco de Lasuen, Presidente of the Missions, on January 12, 1796, recommended to Governor Borica that a mission be established on Fr. Danti's site and in February the Governor forwarded Fr. Lasuen's recommendation to Viceroy Branciforte in Mexico City together with a petition for authority to found four other missions.

The Viceroy gave his approval on August 19, 1796, an appropriation was made from the Pious Fund for the five additional stations and 10 friars volunteered for California service. On May 5, 1797, Fr. Lasuen informed Borica that the new missionaries were on their way and that the work of founding the missions might begin. Says Fr. Zephyrin Engelhardt, mission historian:

"The Governor immediately directed the commandante at San Francisco to detail Corporal Alejo Miranda and five men for the new mission of San Jose. On June 9th, Fr. Lasuen and Sergeant Pedro Amador with a party of soldiers started out from Santa Clara for the spot known as San Francisco Solano. Here on Trinity Sunday, June 11th, he raised and blessed the cross. In a shelter of boughs he celebrated Holy Mass, and thus dedicated the mission in honor of the foster-father of Christ, San Jose. On the same day Fr. Lasuen returned to Santa Clara and reported the event to the Governor. The first missionaries appointed for San Jose were Fr. Isidoro Barcenilla and Fr. Augustin Merino."

UNRULY INDIANS

While it never grew to extensive proportions, Mission San Jose in 1831 had the greatest number of neophytes of any other California mission with the exception of San Luis Rey. It had 1,866 persons on its rolls. Crops averaged 1,630 bushels annually during the period of its existence from 1797 to 1834. Its total number of baptisms during that time was 6,737; marriages numbered 1,984 and there were 5,109 burials.

In nine years' time, the mission furnished $15,125 worth of supplies to the San Francisco presidio.

George Wharton James says that the mountain Indians near San Jose did not like the presence of the missionaries, consequently the padres were apprehensive of trouble from the start. However, there was no serious trouble until January, 1805, when Fr. Cueva was called upon to visit some sick neophytes on a rancheria some 15 miles east of the mission. He went to see them escorted by Major-domo Higuera and two soldiers. The party was set upon by hostile natives. Higuera was killed, a soldier badly wounded, three neophytes and the expedition's horses killed and Fr. Cueva was badly beaten up, barely escaping with his life.

The remaining soldier killed one of the Indians and managed to get the padre back to the mission. A report

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into northern Washington.

Present day State highways lead to all the mission sites. Now that the war is ended, California looks forward to again welcoming tourists from all over the world. With the resumption of normal automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways is publishing in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions are taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the tenth of the series.



This was Mission San Jose de Guadalupe in the days when peace and prosperity reigned. Reproduction of an old etching

of the affair was sent to San Francisco and an armed force under Sergeant Peralta, reinforced by 34 settlers from San Jose, pursued the fleeing Indians, killed 11 of them and captured 30, mostly women. Peralta made another foray in February, but found the natives submissive and repentant. One chief came from as far away as the San Joaquin River to tell the sergeant that he and his people had taken no part in the attack on Fr. Cueva.

EXPLORE INTERIOR

Von Langsdorff in his "Voyages," published in London in 1814, tells of a visit he made to Mission San Jose in April, 1806. He wrote:

"Every year military expeditions are sent out to obtain a more exact knowledge of the interior of the country, with a view, if possible, of establishing, by degrees, a land communication between Santa Fe and the northwest coast of America. While I was at the Mission of St. Joseph, 13 soldiers, with a sergeant and corporal, arrived there on their return from one of these expeditions. These people asserted that they had penetrated between 80 and 90 leagues into the country, and had arrived in the neighborhood of a high and widely extended chain of hills, covered with eternal snow; this chain is known to the Spaniards under the name of the Sierra Nevada, or Snowy Mountains. The river, or rivers of St. Francisco and another stream which flows into the sea near St. Michael, must have their sources in these mountains.

"Individual inhabitants of the Sierra Nevada affirm that three or four days journey eastward of this chain, they have seen men with blue and red clothing, who entirely resembled the Spaniards of California; they were very probably soldiers of Santa Fe, who had been sent on a similar expedition from the Eastern Coast, to examine the interior of the country westwards.

"According to this information, the Spaniards, between the thirty-fifth and thirty-eighth degrees of latitude on the different sides of the continent, must have come pretty near to each other; a probability is thus afforded, that, in time, a regular inland communication may be established between Santa Fe and St. Francisco."

PROSPEROUS TIMES

Of the mission buildings, Langsdorff wrote:

"Although it is only eight years since they were begun, they are already of very considerable extent: the quantity of corn in the granaries far exceeded my expectations . . . The kitchen garden is well laid out, and kept in very good order; the soil is everywhere rich and fertile, and yields ample returns. The fruit-trees are still very young, but their produce is as good as could be expected. A small rivulet runs through the garden, which preserves a constant moisture. Some vineyards have been planted within a few years, which yield excellent wine, sweet and resembling malaga.

"The situation of the mission is admirably chosen, and according to the universal opinion, this mission will in a few years be the richest and best in New California. The only disadvantage is, that there are no large trees very near. . . . To compensate this disadvantage, there are in the neighborhood of the mission chalkhills, and excellent brick earth so that most of their buildings are of brick. The organization of the institution is entirely the same as at San Francisco. The habitations for the Indians, las rancherias, are not yet finished, so that at present they live chiefly in straw huts of a conical form."

EXPEDITION UP SAN JOAQUIN

The new church at Mission San Jose was completed on April 23, 1809, and Fr. Presidente Estevan Tapis, who had succeeded Fr. Lasuen, blessed it. The following day he preached an inspired sermon and Fr. Arroyo de la Cuesta said mass before a gathering of priests.

soldiers, citizens of the pueblo of San Jose and a large congregation of neophytes.

The zealous padres of the mission, Fr. Fortuni and Fr. Abella in 1811 went on a trip of exploration to the Sacramento and San Joaquin Valleys. They found the Indians peaceful and recommended that a mission be established on the shores of the Sacramento. This never was done.

In 1817 an expedition under Sergeant Soto with 100 neophytes from the mission and 12 soldiers from San Francisco went in pursuit of hostile Indians who had fled up the San Joaquin River. Soto reported that they encountered a thousand natives on an island in the river who immediately attacked them. Soto's forces killed many of them and lost only one neophyte.

James tells of the expedition against Chief Estanislas in 1826. He wrote:

"Owing to its situation, being the first mission reached by trappers, etc., from the East, and also being the nearest to the valleys of the Sacramento and San Joaquin, which afforded good retreats for fugitives, San Jose had an exciting history. In 1826 there was an expedition against the Cosumnes, in which 40 Indians were killed, a rancheria destroyed, and 40 captives taken. In 1829 the famous campaign against Estanislas, who has given his name to both a river and county (Stanislaus), took place. This Indian was a neophyte of San Jose, and being of more than usual ability and smartness was made alcalde. In 1827 or early in 1828 he ran away, and with a companion, Cipriano, and a large following, soon made himself the terror of the rancheros of the neighborhood. One expedition sent against him resulted disastrously, owing to insufficient equipment, so a determined effort under M. G. Vallejo, who was now the commander-in-chief of the whole California Army, was made. May 29th he and his forces crossed the San Joaquin River on rafts, and arrived the next day at the scene of the former battle. With taunts, yells of defiance and a shower of arrows, Estanislas met the coming army, he and his forces hidden in the fancied security of an impenetrable forest. Vallejo at once set men to work in different directions to fire the wood, which brought some of the Indians to the edge, where they were slain. As evening came on 25 men and an officer entered the wood and fought until dusk, retiring with three men wounded. Next morning Vallejo, with 37 soldiers, entered the wood, where he found pits, ditches, and barricades arranged with considerable skill. Nothing but fire could have dislodged the enemy. They had fled under cover of night. Vallejo set off in pursuit, and when two days later he surrounded them declared they would die rather than surrender. A road was cut through the chaparral with axes, along which the field piece and muskets were pressed forward and discharged. The Indians retreated slowly, wounding eight soldiers. When the cannon was close to the enemies' intrenchments the ammunition gave out, and this fact and the heat of the burning thicket compelled retreat. During the night the

Mission San Jose as it is today, restored and an attraction to Californians and out-of-State visitors alike





One enters Mission San Jose under this vine-covered arbor

Indians endeavored to escape, one by one, but most of them were killed by the watchful guards. The next day nothing but the dead and three living women were found."

JEDEDIAH SMITH ARRIVES

In 1826, Jedediah Smith came to California from Great Salt Lake and was received with suspicion by the officials of California, who resented the intrusion of outsiders. Smith finally arrived at Mission San Jose and later was accused by Fr. Duran of enticing 400 of his neophytes to run away. The charge was not substantiated. Smith, as history records, returned across the Sierras to Salt Lake, the first to make the trip. His party was compelled to eat all its horses to escape starvation.

The mission was secularized in 1836-37 and M. G. Vallejo was named administrator, serving until 1840, when he was succeeded by Jose Maria Amador. An inventory placed a value of $155,000 upon the mission property, not including the church and church ornaments. When Governor Michel-torena returned the missions to the Franciscans in 1843 the padres made an effort to recover their herds of cattle and horses and other assets, but failed. The fields were overrun with weeds and neglected. The missionaries were surrounded by devastation and asked to be relieved. On May 5, 1846, Governor Pio Pico, who sold all but one of the missions to private individuals and friends, disposed of Mission San Jose to Andres Pico and J. B. Alvarado for $12,000.

An earthquake destroyed the chapel in 1868. The new chapel was built on the foundations of the old, but in no way resembled it. A portion of the old monastery remains and efforts have been made at restoration. In 1884 an orphanage was erected for young men who wished to study for the priesthood and in 1891 a modern orphanage took its place and is conducted by the Dominican Sisters. Some of the old olive trees planted by the early padres remain.

Mission San Jose is about 15 miles north of the city of that name and is easily reached by auto or bus. The visitor may go from Oakland over a splendid State highway, U. S. 101 E, or from San Francisco to Redwood City, thence to Niles and four miles southwest to the mission. Or by Southern Pacific from San Francisco to Irvington and thence by bus to the mission. San Joaquin Valley visitors will go from Stockton to Livermore thence on State Highway No. 5 and southwest on State Route 108 to the mission.

San Francisco de Assisi
October 9, 1776

WHILE historians generally use October 9, 1776, as the date of the founding of Mission San Francisco de Assisi, better known as Mission Dolores, Fr. Zephrin Engelhardt, noted mission historian, fixes June 29, 1776, as the day on which this, the sixth of the early Franciscan missionary stations, was established and seemingly proves it by old records, as we shall see.

Fr. Engelhardt says that divine Providence appears to have singled out the region around the great inland harbor of northern California for the scene of Indian missionary activity under the patronage of the Seraphic St. Francis. The story of the discovery of San Francisco Bay reads like fiction. It first was related by Fr. Francisco Palou, the biographer of Fr. Junipero Serra, who wrote in his diary:

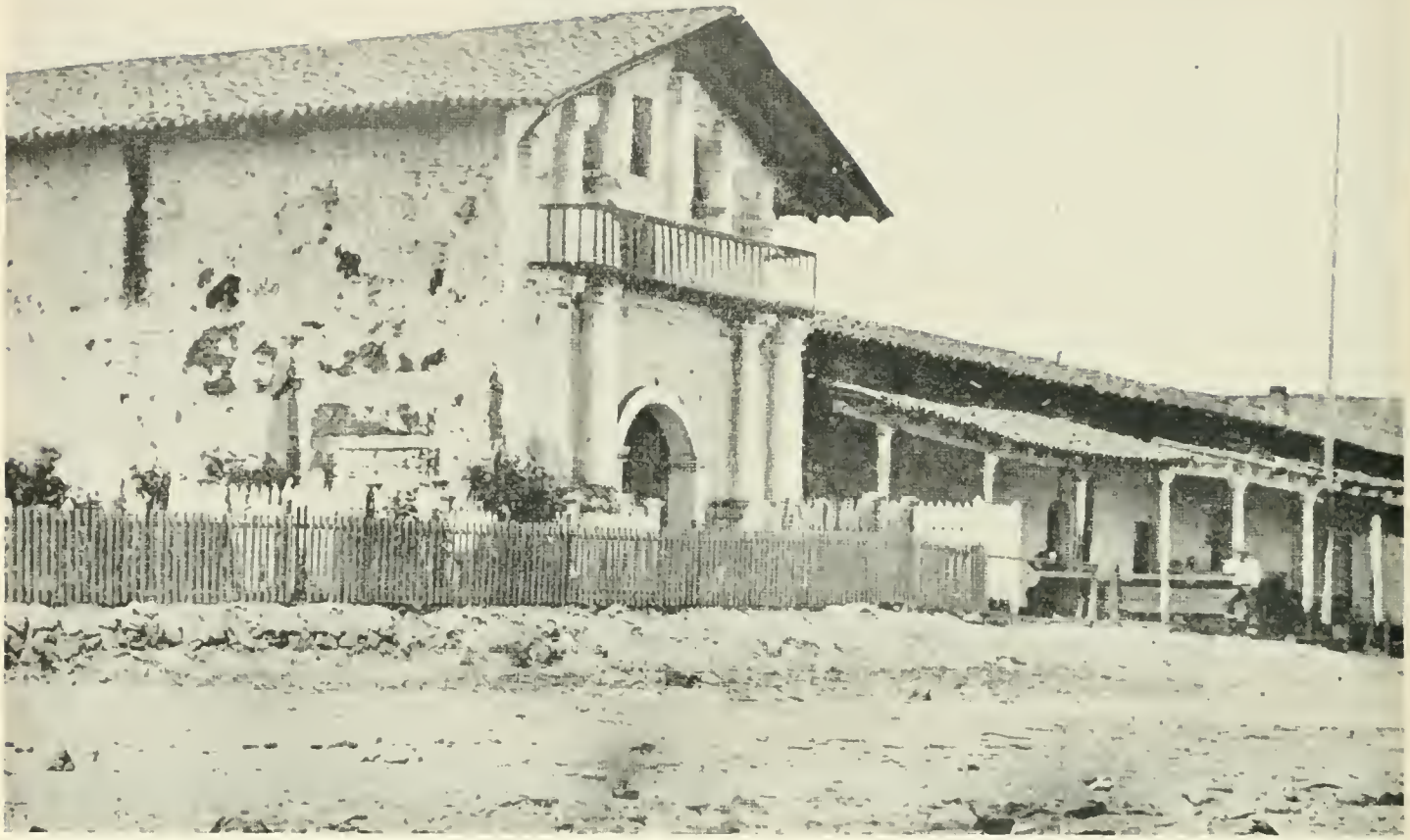
"When, late in 1768, the venerable Fr. Junipero Serra consulted the Inspector General, Don Jose de Galvez, on the first three missions which Galvez had directed him to establish in Upper California and observed the names of the patron saints that were to be assigned, he said to him: 'Is there then to be no mission for our Father San Francisco?' Don Jose de Galvez replied: 'If San Francisco wants a mission, let him cause his port to be discovered, and it will be placed there.'"

PORTOLA EXPEDITION

Fr. Palou tells of the expedition of Gaspar Portola which, after the founding of Mission San Diego in July, 1769, went north in search of Monterey Bay. Says Fr. Palou:

"The expedition went up; it reached the port of Monterey; it halted and planted a cross there, yet not one of those who went along recognized it, although they made out all the landmarks in the history. They continued forty leagues farther; came to the Port of San Francisco; and at once all recognized it from the conformity with the description which they had brought along. In view of this what else must we say than that our holy Father wanted a mission at this port."

However, the famous bay discovered by Portola was not the Port of San Francisco known to Galvez. It was entirely unknown to the Spaniards. In 1595, Sebastian Rodriguez Cerme-



Chapel structure of old Mission San Francisco de Assisi, now known as Mission Dolores, which, in restored condition, is a part of the present day Mission

non, a Portuguese navigator, set sail from Manila under royal Spanish orders to explore the cost of California and on November 6 of that year he cast anchor in a little bay behind a point of land later called Punta de los Reyes and gave to it the name of Bahia de San Francisco in honor of Saint Francis of Assisi.

SAN FRANCISCO BAY

Of the present San Francisco Bay nothing was known to the world till 173 years later. When the members of the Portola expedition sighted it on October 31, 1769, they believed it to be the bay Cermenon had discovered. Some years later, after a number of explorations had been made on the San Francisco peninsula and through what now are Alameda, Contra Costa and Marin counties, the Spaniards transferred the name San Francisco from the little bay at Point Reyes to the world-renowned body of water that now is San Francisco Bay and on its western shore established Mission Dolores.

Monterey Bay having been located in May, 1770, by Portola's second land expedition and a sea expedition of which Fr. Serra was a member, Viceroy Carlos Francisco de Croix of Mexico ordered a survey of San Francisco Bay region in order to find a site for a mission. Portola had turned military control of California over to Lieutenant Pedro Fages and in March, 1772, Fages and Fr. Crespi left Monterey for San Francisco. After wandering over considerable territory, the party returned to Monterey.

On November 23, 1774, a second exploring force under command of Captain Fernando Rivera y Moncada and accompanied by Fr. Palou set out from Monterey for San Francisco. On December 4th the Spaniards camped on the side of a hill at the foot of which ran a stream which formed a lake that extended to the ocean beach, and was called Lake Merced.

DISCOVER POINT LOBOS

"An hour later," says Fr. Engelhardt, "Captain Rivera, Fr. Palou and four soldiers went toward the northwest over hills and dales and with difficulty waded through sand dunes down to the shore. Thence they went northward until, in sight of the now famous Seal Rocks, they were stopped by a steep hill, which is identical with the present Sutro Heights. They ascended, and after a while found themselves on the summit of Point Lobos and in full view of the Golden Gate or channel to San Francisco. Observing that the steep declivity was at the very entrance of the channel and that no Spaniard or Christian ever had set foot on its summit, Rivera and Fr. Palou resolved to plant the Standard of the Cross there. It was accordingly constructed of strong round timber and raised on the spot where it could be seen from the shore. Thereupon the little party returned to camp."

The expedition retraced its march to Monterey arriving there on December 13, 1774.

That same month, the Viceroy ordered Captain Juan Bautista de

Anza to proceed overland from Sonora, Mexico, to Monterey, there recruit troops and take them and their families to San Francisco to colonize that region and protect the mission it was proposed to found there. Fr. Pedro Font accompanied the party. Fr. Font recorded in his diary that the expedition upon arriving at San Francisco came upon a lovely creek which, because it was Friday, the feast of our Lady of Sorrows—Nuestra Senora de los Dolores—was named the Arroyo de los Dolores.

In May, 1776, Lieutenant Jose Joaquin Moraga was ordered to proceed to San Francisco from Monterey with a party of colonists and Fr. Serra sent Fr. Palou and Fr. Cambon with him.

Fr. Engelhardt quotes from Fr. Palou's diary as follows: "On June 27th the expedition arrived near its destination. The commander ordered camp to be pitched on the bank of a lagoon which Senor Anza had named Nuestra Senora de los Dolores. * * * On the day after our arrival, the commander ordered an enramada (arbor) to be constructed which was to serve as a chapel for celebrating the holy Sacrifice of the Mass. On an altar erected within I celebrated the first holy mass on June 29th, the feast of the great holy Apostles St. Peter and St. Paul. My companion missionary celebrated holy mass immediately after, and we continued celebrating holy mass there every day for an entire month until the camp of soldiers was transferred to a site near the landing place."

"Hence," says Fr. Engelhardt, "June 29, 1776, five days before the Declaration of Independence of the United States, was really the date of the founding of the Mission Dolores or San Francisco de Assisi, although officially other dates are reported."

On July 26th, the troops and colonists removed to a site selected by Colonel Anza and immediately began to build barracks and houses. On July 28th, Fr. Palou celebrated the first holy Mass on the military site, "which day, therefore," says Fr. Engelhardt, "might be regarded as the date of the founding of the Presidio of San Francisco."

Sailors from the San Carlos, which had arrived from Mexico with supplies, were assigned to help the padres to erect the mission building. The chapel was blessed on October 3d and on October 9th the ceremony of formally opening the mission was performed.

(Continued on page 29)

San Franciscans are prideful of their Mission Dolores which is shown in this recent photograph



Bridge Maintenance Practice On California Highway System

By O. M. UHL, Associate Bridge Engineer

THERE are 4,636 bridges on the California State Highway System, omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is $125,000,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenance and Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the ninth. It deals with Concrete Disintegration.

THE disintegration of concrete on California bridges located at high altitudes is presenting an aggravating and difficult bridge maintenance problem. Generally, it has been found that railings and curbs are more seriously affected than other bridge members. Efforts to preserve and repair these members have been quite discouraging thus far: a forthright solution of the problem has not been obtained.

The States of Oregon, Nevada and others have reported similar evidences of deterioration due to weathering at high altitudes. Mr. F. H. Jackson of the Public Roads Administration has written a very interesting and comprehensive article covering this subject in the 1945 April-May-June issue of *Public Roads*. His illustrations of failures in neighboring Western States are similar to those exerienced on California bridges.

Failures due to cement alkali-aggregate reaction will be referred to only briefly in this article. Mr. T. E. Stanton, Materials and Research Engineer of the California Division of Highways, has made exhaustive studies * in connection with this type of disintegration which has occurred in various locations in California.

* *See Proceedings of the American Society of Civil Engineers, dated December, 1940.*

Truckee River Bridge near Polaris on U. S. Highway 40



The subject of concrete deterioration will be discussed under the following headings:

(a) Experiences on California bridges.
(b) Repair of deteriorated surfaces.
(c) Problem of weathering.
(d) Recommendations for new bridges.
(e) Use of air-entraining cement.
(f) Conclusion.

EXPERIENCES ON CALIFORNIA BRIDGES

Concrete disintegration due to freezing and thawing frequently occurs in the higher altitudes of the State and is common to most concrete aggregates regardless of source. Efforts have been made to trace the cause to reactive aggregates, but this is believed to be only one of the contributory factors in this type of deterioration.

A climatic study covering a period of 26 years at Truckee shows the temperature to have varied from —28 degrees to 101 degrees F. The average annual precipitation was about 26 inches. At Soda Springs, which is three miles west of Donner Summit, it was nearly 46 inches over a 40-year period. Truckee and Soda Springs are at 5,818 feet and 6,752 feet elevation, respectively. In 1938 there were 178 days at Soda Springs, during which the temperature rose to at least 38 degrees F. and dropped below 32 degrees F. This represented 178 cycles of freezing and thawing during one year. Frost occurs as late as June 20th and as early as August 20th.



Chipped edge of curb of Polaris Bridge may be seen under railing

which gives some indication of the problem of construction relative to the freezing of green concrete at these high altitudes.

POLARIS BRIDGE

Among the first bridges to require treatment and repairs caused by weathering aggravated by reactive aggregates, was the Polaris bridge over the Truckee River (Photo No. 1). It is located on U. S. Highway Route 40 about four miles east of Truckee. The structure was designed and constructed under State supervision and completed in 1925. During 1937 repairs to the railings and curbs became necessary due to weathering. The spalled edges of the curbs and railings were chipped off and replaced with mortar, and the scuppers were plugged (Photo No. 2). However, shrinkage cracks soon appeared in these patches, and in other cases, the old concrete failed on the sides and behind the patches. The concrete in the curbs and railings closely resembles chalk, has a light grey color, and a moderate blow with a prospector's pick will sink about one-half inch into the distressed concrete.

During more recent years the concrete deterioration on the Polaris bridge has advanced considerably (Photo No. 3). Portions of the arch ribs (Photo No. 4), particularly at the construction joints, and edges and corners of the columns and caps, have disintegrated rapidly. Last year major repairs were proposed for all distressed members, but this work was postponed on account of the war. It is now planned to perform this work during the summer of 1946.

EXAMPLES OF DISTRESS

Examples of distress and failures in concrete railings on other bridges at high altitudes are shown in Photographs Nos. 5, 6, 7 and 8. These railings have now been treated with proprietary cement paints, with the exception of the Donner Creek bridge railing which was replaced with a timber railing. The proprietary cement paints were applied in 1944 and 1945, and sufficient time has not elapsed in which to draw accurate conclusions as to the effectiveness of such paints.

REPAIR OF DETERIORATED SURFACES

Numerous methods have been proposed and several of these have been applied, in the attempt to seal surfaces affected by pattern checking and minor crazing. A listing and discussion of some of these treatments follows:

1. Use of gunite or shotcrete.
2. Sealing of surfaces with cement paints.
3. Impregnation with bituminous and related products.
4. Protection with linseed oil, water glass and oil base paints.

(1) Gunite has been used extensively for repairing and preserving concrete structures damaged by all types of disintegration, but it has not been used on California bridges subjected to failures brought on by weathering. It has not been used to repair railings and curbs due to the small sections found in such members. Bringing in equipment and setting it up on a small bridge, together with the excessive waste of materials generally, makes the cost of this method of repair relatively high.

CEMENT PAINTS

(2) Cement paints, where they have been applied to date, have been rather unsatisfactory in repelling the effects of severe weathering on concrete surfaces. Several such paints were applied during 1945 and first observations of results will be made this spring and summer. Those applied earlier have not given the satisfaction expected. Cleaning of deteriorated surfaces, before application of these paints, is very important. It usually requires sandblasting (as recommended by manufacturers of most proprietary paints) to insure proper adhesion to the old surfaces. When acids and caustics are used for cleaning purposes, the thorough removal of the residues which are formed is imperative to insure effective results.

The use of a proper brush is important in the application of cement-water paints. Wide paint brushes or whitewash brushes may be used to obtain satisfactory results for paint applications. In order to obtain good appearance, care should be exercised in applying the final coat.

ADEQUATE CURING

Provisions for adequate curing are essential. Burlap may be draped over the surfaces, after the initial set has

This photo shows concrete deterioration on Polaris Bridge



been attained, and water-saturated as required by prevailing atmospheric conditions. Approved colorless curing membranes are also available and are satisfactory if properly applied.

There are a great many proprietary admixtures available for use with cement-water and mortar paints. A number of these admixtures have been used on our bridges, but have not thus far lived up to expectations.

The U. S. Department of Commerce has published a report (BMS 95) which gives results of a series of permeability tests made on waterproofing products for masonry walls. A large number of different types of paints were tested in this series of experiments, among which were cement coatings (with and without admixtures), proprietary products and asphaltic membranes.

WATERPROOFING CONCRETE

(3) Petroleum products may be used for waterproofing concrete. They have been used by the Bridge Department, particularly for sealing the top surfaces of subway slabs. There are products of bituminous rubber composition which possess: (a) Elasticity; (b) noncracking qualities when subjected to variations in temperature; and (c) resistance to flow at relatively high temperatures. Federal specification SS-F-336 has been written to cover these products.

(4) The Oregon State Highway Department has had success with applications of linseed oil,* and standard white lead and oil paints on deteriorated concrete surfaces. A reference to this treatment may be found in the Public Roads magazine mentioned earlier in this article. Here, again, the need of thorough cleaning can not be over-emphasized. All loose materials, dust, old paint, etc., must be completely removed to insure success.

The State Maintenance Department has used lacquers and standard guard rail (white lead and oil) paints frequently on bridge end posts, tops of railings, and curbs. However, the primary object for its use is visibility. These paints weather rapidly and soon flake off. The problem of renewing them requires a large amount of cleaning and is relatively expensive.

USE OF SODIUM SILICATE

Sodium silicate (water glass) and lacquer have been used for the protection of concrete with hair checks and incipient disintegration. After cleaning, the surfaces were treated with five coats of sodium silicate diluted with water in a ratio of 1:5 for the first coat and gradually decreased to a ratio of 1:2 for the last coat. These coats were applied after successive intervals of 24 hours. Finally, the surfaces were painted with white traffic lacquer. This method fails to provide a sufficiently adequate seal. The lacquer must be renewed about every three years.

** First suggested by Portland Cement Association.*



Portions of arch ribs of Polaris Bridge have disintegrated

PROBLEM OF WEATHERING

The problem of weathering of concrete is controversial; many solutions and explanations have been advanced regarding it. The disparity between the effects of weathering of railings and curbs, as compared with other bridge members is a subject of even greater speculation. The reasons why

certain aggregates have failed at high altitudes, and on the other hand, have proved satisfactory in localities with milder climates, have not been definitely proved. There are bridges at high altitudes which are old and have not suffered from weathering. Why the design and fabrication of these structures, and the aggregates used in them, have resulted in greater permanency is problematical.

Some of the reasons for the disparity referred to in the last paragraph are:

CURBS MORE EXPOSED

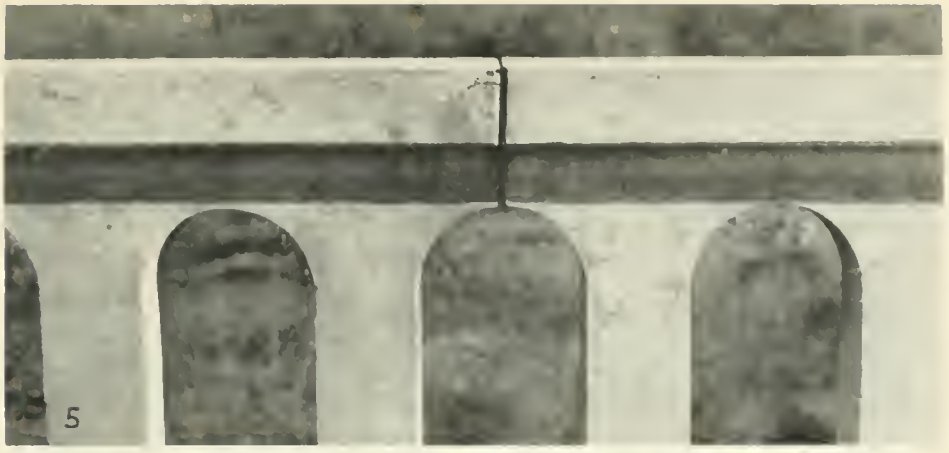
(1) The members of handrails and curbs are more exposed to the elements, are thin, and have a larger surface area per unit volume than other bridge members. Therefore, the elements have a greater and freer opportunity to attack them.

(2) Early specifications often required a richer concrete mix in railings. Seven sack, and sometimes even richer mixes were used to promote workability and permit the use of higher slumps. Naturally, concrete of these rich mixes promoted shrinkage, checking and more serious retrogression. This type of deterioration has been particularly severe at high altitudes.

(3) The surfaces of concrete railings and curbs receive special hand finishes which alter the surface texture and result in nonuniformity. This causes differentials in volume changes, due to moisture absorption and temperature variations, and leads to pattern checking and crazing. In this regard, it is interesting to observe that certain prefabricated railings (diamond-shaped) on a number of old bridges have withstood the effects of weathering remarkably well. Examination of such railings shows that their surfaces have a uniform, rough, sandy texture. This is striking proof of the need of uniformity and elimination of unnecessary troweling and over working of concrete.

COMMON METHODS OF CURING

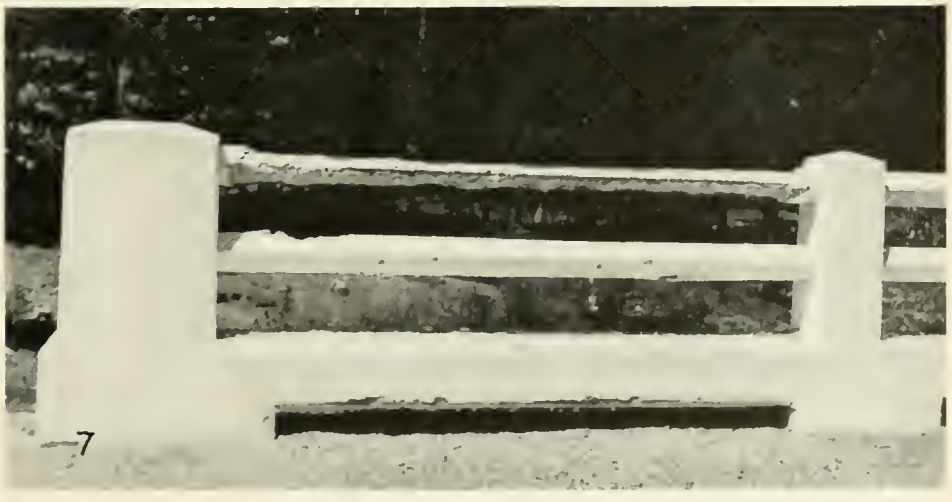
The common methods of curing railings and curbs is generally inferior to that used for roadway slabs, girders, piers and abutments. Slabs on bridges are usually kept continuously wet by ponding or other approved methods. Forms are allowed to remain on the faces of girders, piers, etc., for stipulated periods to provide proper curing. Railings and curbs usually do not receive equally effective curing.



Shasta River Bridge on U. S. Highway 99 in Siskiyou County



Ash Creek Bridge on U. S. Route 299 in Modoc County



Donner Creek Bridge on State Route 38 in Nevada County

(4) Concrete cast in handrails is designed from smaller sized aggregates than that used in heavier sections. This leads to larger proportions of sand and higher water-cement ratios. These sacrifices in the design of concrete mixes result in inferior concrete, other factors being equal.

(5) As stated earlier in this article, the probability of encountering freez-

ing weather at high altitudes during construction is very likely. Even the best and most carefully prepared construction schedules oftentimes can not be maintained for reasons beyond the control of the engineer and the contractor. Consequently, some of our bridges constructed by the various public agencies* may have had failures caused by the freezing of green concrete. As curbs and railings are frequently poured late in the fall, they are particularly vulnerable to this condition. Precautions should be taken to protect them, especially the railings.

RECOMMENDATIONS FOR NEW BRIDGES

As a result of past experiences, it is apparent that the following precautions and improvements should be adopted for concrete placed at high altitudes:

(1) Provide better uniformity. Do not over vibrate and work concrete excessively. Avoid special surface finishes, unnecessary troweling and flushing of mortar to surfaces.

Mr. F. R. McMillan of the Portland Cement Association has made a pertinent suggestion in regard to placing concrete at the tops of construction joints, which will produce more durable concrete in these locations. He suggests pouring the concrete several inches above the pouring strip and allowing it to remain in this position a short time. This will allow excess moisture and laitance to rise to the surface. When the excess concrete is removed it will eliminate the porous and segregated concrete which is usually found in these locations. The added expense caused by this technique should provide cheap insurance for structural permanency.**

(2) Provide better curing technique for curbs and railings. The use of approved, colorless, curing membranes, uniformly applied, offers one solution to this problem.

(3) Use as large a coarse aggregate as consistent with size of members and workability.

(4) Keep reinforcing steel full distance from all surfaces. A minimum coverage of two bar diameters should be carefully maintained.

(5) Specify cements with low alkali contents.

(6) Use air-entraining cements.

(7) Maintain a construction schedule which will eliminate the possibility of freezing green concrete.

In addition to the above improved techniques, laboratory studies regarding the causes and elimination of failures experienced on existing bridges are being made. Studies of preservation and repair of deteriorated concrete surfaces are being coordinated by field and laboratory work.



Bear Creek Bridge on State Route 140 in Mariposa County

USE OF AIR-ENTRAINING CEMENT

To date, concrete containing air-entraining agents or other means of increasing resistance to freezing and thawing, with the possible exception of pozzolana, have not been used on California highways. Air entrainment promises the best solution to the problem of obtaining weather resistant concrete.

Approved air-entraining agents consist of animal fats, vegetable oils or resins. These substances react with the alkalis in cements, in the presence of water, to form soap. During the mixing of the concrete the soap creates a maze of microscopic air particles which are believed to act as lubricants for the aggregates in the concrete. When moisture enters the concrete, condenses, and freezes, these minute particles of air form effective cushions which prevent the breakdown of the structural elements, particularly the fine aggregates.

TWO METHODS

There are two methods of adding air-entraining agents to concrete: (a) Intergrinding the agent with the cement clinker; (b) adding the agent at the mixer.

It is claimed the former method of adding the agent is objectionable, as it does not offer proper field control for air entrainment. Requirements vary with water-cement ratio, cements, aggregates and time of mixing. Variable proportions of air content are required by different jobs and specifications. For these reasons it would seem more satisfactory to add the agent when the concrete is being mixed in the field. Samples can be weighed by the engineer and the desired air content obtained.

It has been demonstrated by field experience that the optimum percentage of air content, for durability, varies from 3 to 5 per cent. Ordinary concrete contains slightly more than one per cent of air. This, again, shows the need of close field control of air entrainment. These percentages of dispersed air result in a loss in weight of the concrete of from about 4 to 7 pounds per cubic foot. Corresponding losses in flexural strength of the concrete may vary from 8 to 20 per cent. It has also been shown that the qualities of air entrainment are not as effective with both lean and comparatively rich concrete, as it is with mixes of moderate proportions. Specifically, the optimum effects are attained with mixes designed for 5- to 6-sack concrete.

The American Society of Testing Materials has recognized two products, Vinsol resin and Darex AEA,* which may be used for air entrainment. Vinsol resin itself is nonsoluble in water and requires a catalyst to make it active. The manufacturer now produces a neutralized (saponified) Vinsol resin which avoids the necessity of using caustics to saponify

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** The Public Roads Administration and some Counties have all had similar concrete failures.*

*** Mr. Jackson has discussed and recommended this procedure.*

** Vinsol resin and Darex AEA are manufactured by the Hercules Powder Company and Deucy and Almy Chemical Company, respectively.*

Work on New Santa Ana Freeway In Los Angeles Is Well Under Way

By A. N. GEORGE, District Construction Engineer

CONSTRUCTION work on that section of the new Santa Ana Freeway extending from Kearney Street to Soto Street in Los Angeles is well under way.

This freeway will connect with the Ramona Freeway just east of the Aliso Street Bridge over the Los Angeles River and the traffic from the two freeways will cross the river on the Aliso Street Bridge and reach the Civic Center via Aliso Street. The Aliso Street Bridge was built by WPA forces, the nonlabor costs being furnished jointly by the Union Pacific Railway, The Atchison, Topeka & Santa Fe Railway, the Pacific Electric Railway, the City of Los Angeles, the County of Los Angeles, and the State Division of Highways.



Looking south from existing Sixth Street Bridge, showing a fill in process of construction

BIDS OPENED

Bids were opened on that section of the Santa Ana Freeway extending from Kearney Street to Soto Street, on December 6, 1945, together with bids for the construction of the bridges to carry Fourth Street and Seventh Street over this freeway. Peter Kiewit Sons' Co. was the low bidder on the road work and Byerts & Dunn was the low bidder on both bridges.

When completed, the Santa Ana Freeway will extend from the Civic Center of Los Angeles to Santa Ana. Considerable time will necessarily elapse before funds can be made available to complete the entire freeway but it is hoped that it will be possible to carry the freeway outside of the most congested portion of Los Angeles with the funds now in sight.

The portion of the freeway now under contract is to have three 12-foot traffic lanes in each direction, with a dividing island in the center. Both cut and fill slopes are being made flatter than required by previous standard, and the contract calls for the installation of sprinkling systems on the slopes and for top-soil to be distributed over all of the areas of the right of way not occupied by pavement and shoulders, so that planting can be made to flourish.

AID GIVEN TENANTS

The award of the contract for the road work was delayed until January 23, 1946, due to the number of tenants living on the right of way who would have to be moved in order to make way for construction. The housing situation in Los Angeles is so serious that a real hardship would have been placed on these people if they had been forced to move without being given help in locating new quarters.

The Right of Way Department went to work to assist the families whose living quarters had to be moved or demolished. Arrangements were made with the Los Angeles City and the Federal housing authorities for the use of a number of federally-owned house-trailers and many families moved into these. Arrangements were also made whereby the tenants in many other buildings were allowed to occupy the buildings while they were being moved to a new site and for at least six months thereafter. In other cases, houses were sold to be moved, with the provision that the purchaser would provide other rental quarters for the tenants for at least six months. In this way all of the 210 families affected were located in new quarters and the State made no arbitrary evictions.

CONTRACTS TOTAL $1,820,350

The contract allotment, including all contract items, supplemental work and



Looking northerly from Sixth Street Bridge. In foreground reinforcing of an existing storm drain which will be under quite a high fill is in progress

contingency fund, for the road-work project amounts to $1,435,325.12.

The contract allotment for the Fourth Street Bridge amounts to $145,-204.50; and the allotment for the Seventh Street Bridge amounts to $239,821.05.

Work was started on the Fourth Street Bridge on January 22, 1946, and on the roadway on January 31, 1946. Both projects are proceeding at an excellent rate of progress.

One of the interesting features of the work consists of the jacking of a 36-inch reinforced concrete pipe under three tracks of the Union Pacific Railroad Company's main line and under a warehouse. This work was subcontracted to the Armco Drainage & Metal Products, Inc., and is approaching completion, the work having been carried on in a remarkably smooth manner, cooperation between the contractor and the Union Pacific being excellent.

ROUTE SKIRTS PLANTS

This Kearney-Soto portion of the Santa Ana Freeway, 1.6 miles in length, is located through an area which was occupied by many substandard dwellings, and skirts housing projects that were constructed prior to the war; but these housing projects were located to conform to the freeway right of way. The freeway also skirts many industrial plants; but it was possible to avoid interfering with any of the large establishments.

Mr. H. C. Studer is job superintendent for Peter Kiewit Sons' Co.; and Mr. E. A. Parker is Resident Engineer for the State on this job. Mr. George K. Thatcher is job superintendent for Byerts & Dunn; and Mr. A. K. Gilbert is Resident Engineer on the two bridges.

BAYSHORE FREEWAY

(Continued from page 4)

fleet of R.D. 8 tractors and carryalls of various capacities, four 15-cubic yard Woolbridge Terra-Cobras, a fleet of 20-cubic yard dump trucks and a 2½-cubic yard shovel.

Barring unforeseen delays, this project should be opened early in 1947.

The roadwork is being executed under the general direction of Jno. H. Skeggs, District Engineer, with Mr. A. Walsh, Resident Engineer, in immediate charge.

Ancient "Weather Map" on U. S. Highway 40

By G. B. ASHCROFT, Senior Structural Engineer, Division of Architecture

SOME 30,000,000 years ago, more or less, there was being slowly laid down in an ancient river channel an orderly sequence of gravel deposits which became eventually a record indicative of the climatic conditions of the times. A huge "weather map," so to speak.

When in 1932, U. S. Highway 40 in the vicinity of Gold Run was rerouted and moved to the southern side of the railroad tracks and carried across the old pit of the Stewart hydraulic mine it made easily accessible to the traveling public a portion of the cross-section of one of these ancient "weather maps." For a distance of nearly a mile a remnant of an old Tertiary channel constitutes the prominent cut-bank on the northerly side of the highway.

Next time business or pleasure takes you over this portion of Highway 40, and your time will permit, pause for a moment and examine closely the face of this bank. There are more than 250,000 square feet of it spread out before you. Study the character of the deposits that compose it and observe how a succession of layers of diminishing coarseness that may indicate a period of gradually decreasing annual rainfall is followed by layers of increasing coarseness showing a gradual return to normal conditions and you will realize how this old weather map is trying to tell you that the climate of California 40,000,000 years ago was quite similar to its climate of today.



Section of gravel deposits, thirty million years old, on U. S. 40 near Gold Run

STORY OF MAP

Now, the story of how this map came to be is, briefly, this:

According to the opinions of eminent geologists, who have made profound studies of the origin and history of the Sierra Nevada mountains, there once existed where these mountains now stand a sea in which there was laid down during a long period of time deposits of shale, sand, limestone, etc., until these beds of sedimentary rocks became thousands of feet thick. Upon the length of time all this may have taken the eminent geologists do not agree; some say it was 200,000,000 years; others assert that it was only 100,000,000; be that as it may, we can all agree that it must have been plenty long.

And then began widespread disturbances deep down in the earth's crust beneath this sea during which the sedimentary rocks were compressed, folded, crumpled and finally forced upward several miles above the level of the sea by the pressure and intrusion of granitic magma from beneath. Land appeared and the former sea retreated westward.

And then followed a long, long period of erosion during which the fractured sedimentary rocks were gradually carried away from the higher portions of the range to be redeposited in the western sea, leaving most of the underlying granite exposed. A system of drainage developed where rivers flowing in broad valleys separated by low-rolling divides carried the products of erosion down to the sea. Among these products was the gold which came from the disintegrating quartz veins that once filled the



Thirty million years ago, this Section of U. S. 40 was a river channel of Tertiary times and now is a "weather map" of ancient eras

cracks and fissures in the shattered sedimentary rocks. The gold, however, being of higher specific gravity than the rocks remained behind and slowly concentrated in the gravel at the bottom of the streams.

And forests also developed. How do we know this? From our "weather map" in whose gravels have been preserved for us casts of leaves, fragments of trees, even whole trees, whose wood is so completely silicified that botanists are able to determine the species.

Had there been human hunters or fishermen roaming the Sierras in those days of long ago they would have found themselves among trees like those of today, cedars, oaks and laurel. They would have seen our "weather map" in the making, and noticed how the river bars were composed of very coarse gravels because the rains of the preceding seasons had been heavier than usual; perhaps they would have seen a tree trunk lodged against a boulder and half buried in the bar; or perhaps had they visited this stream some years later they might have found the river's bars composed mostly of sand or fine pebbles because lack of normal rainfall in the preceding seasons had reduced the power of the current to transport the heavier cobbles.

This long period of erosion came to a close toward the end of Tertiary time, perhaps 10,000,000 years ago, if we accept as before the estimates of the eminent geologists. By this time the rugged hills had been reduced to gentler lines; their slopes were covered with a forest growth, and the beds of the rivers were full of gravel and loaded with gold.

Again the forces long pent up within the earth demanded release. Along the crest of the range vents and volcanoes opened and spewed forth enormous quantities of andesite ashes, breccia and mud that flowed far down the slopes of the range destroying every living thing, filling the valleys, covering the hills and burying completely the existing watercourses.

A new system of drainage developed that had little in common with the one that had been obliterated either as to location or direction. The streams began to cut new channels in the surface of the andesite flows and the work of erosion carried on once more. The

(Continued on page 31)

CALIFORNIA MISSIONS

(Continued from page 19)

The missionaries found the Indians in the immediate vicinity very friendly, but they frequently were attacked by enemy tribes from what now is Contra Costa and remained away from the mission for long periods.

Fr. Serra arrived unannounced at Mission Dolores on October 1 and remained there until the 10th. On September 14, 1779, Captain Juan Francisco de la Bodega y Cuadra anchored his ship La Favorita in the bay and out of gratitude for having weathered severe storms presented to the mission a beautiful large bronze engraving of Our Lady of Help which was placed in the mission with due ceremony. On October 28th, Fr. Serra again visited Dolores and viewed the gift of Captain Cuadra with joy. He confirmed 69 persons during his stay.

On April 25, 1782, the first stone for the new church was laid and blessed. Building records from 1782 to 1793 are missing, but when Captain George Vancouver, British navigator and writer, visited there in November, 1792, he made note of the fact that the missionary establishment had grown to considerable proportions. Fr. Engelhardt believes the new mission church, begun by Fr. Palou was dedicated on Sunday, April 3, 1791.

RUNAWAY INDIANS

At the mission in 1796, 20 habitations for neophytes and their families were built. During the first half of the last decade of the eighteenth century the mission made great strides in both spiritual and material progress. The number of baptisms rose from 1031 at the end of 1791 to 1861 at the close of 1795. During the same period the annual yield of wheat, barley and corn was 4,000 bushels.

Beginning in 1795, the fathers had considerable trouble with runaway Indians who left the mission because of an epidemic of measles which caused many deaths in 1794 and 1795. At one time 200 Indians disappeared into the interior across San Francisco Bay. There were several battles between presidio troops and neighboring tribes.

In 1797 the padres and the civil and military authorities clashed over the question of rights to Rancho del Rey which was taken for the troops necessitating the pasturing of mission stock far down the peninsula.

Building activities were brisk up to 1806 when another epidemic of measles brought death to 236 neophytes in nine months. And then in June and July, 1808, severe earthquakes did great damage at the presidio. Little is recorded of the years 1810 to 1816 except that in 1810 Fathers Abella and Lucio reported that the interior of the church had been much adorned.

HIGH INDIAN DEATH RATE

The increase of mortality among the San Francisco Indians resulted in the establishment across the bay in Marin County on December 14, 1817, of an asistencia, or missionary ranch having a chapel, baptistry and cemetery, under the patronage of St. Raphael, the Archangel, out of which grew Mission San Rafael.

In 1818, there were only 600 natives at Dolores while 382 dwelt at San Rafael. Governor Luis Arguello with the approval of Fr. Altimira, who acted without authority, in 1823 planned to discontinue Mission Dolores and Mission San Rafael and move both to a site in what now is Sonoma County and on which later was erected Mission San Francisco Solano at Sonoma. The Franciscan Superiors of the missions succeeded in defeating the scheme.

Lack of space here prevents any detailed account of the hardships endured by Mission Dolores beginning with the regime of Governor Echeandia in 1825 and continuing through secularization up to its confiscation by Governor Figueroa in August, 1834. Mission Dolores was among the first of the Franciscan stations to be confiscated. In September, Jose Joaquin Estudillo was appointed commissioner to take over the mission. Two months later he reported that the debts of the mission amounted to $10,089.63.

FIRST ADOBE HOUSE

In 1836, William A. Richardson built the first adobe house on the site of Yerba Buena. This was the beginning of present day San Francisco.

When Governor Pio Pico began to sell the California missions no buyer could be found for Mission Dolores, so impoverished had it become. During the gold rush, Mission Dolores had many unwelcome guests and was all but abandoned. In February, 1849, Fr. Bromillet was authorized to erect a church at San Francisco, Fr. Santillan, the resident missionary, seldom officiating at the mission. He established the church of St. Francis and some of the church goods of Dolores were given to it.

On March 3, 1858, President James Buchanan returned Mission Dolores to the Catholic church.

Mission Dolores today is surrounded by modern buildings and only the small chapel structure with its charming facade remains. Its old paintings, some of the original floor tiles, ancient vestments, original choir loft and interior decorations executed by Indians of long ago make a visit to Dolores well worth while.

Mission Dolores is located on Sixteenth and Dolores streets in San Francisco, three miles from Third and Market streets and Valencia and Howard street cars will take the mission visitors directly to its doors.

Next—Mission San Rafael Arcangel and Mission San Francisco Solano.

In Memoriam

William E. Dobbins

THE Division of Highways lost another of its faithful and capable employees in the sudden passing of William E. Dobbins who succumbed to a heart attack while on duty near Westmorland, California, on March 19, 1946.

"Bill" as he was familiarly called, was born in Kansas nearly 58 years ago and received his early education in Kansas later attending Polytechnic Engineering School in Oakland, California after which he served in the Armed Forces in Europe in World War I.

He entered the employ of Division of Highways in the summer of 1928 in the northern part of the State as construction foreman later transferring to San Diego County where he served as construction foreman during construction of highway at Lake Henshaw and Moosa Canyon. In April, 1943, he was transferred to Westmorland as maintenance foreman which position he ably filled until time of his death.

He was a member of Table Mountain Masonic Lodge No. 124 and San Diego "Scottish Rite Bodies."

He is survived by his wife, Louella Dobbins, his daughter Mrs. Paul Meier, recently discharged from service in European war zone, a brother Carl Dobbins of Hemet, California, and sisters Mrs. Geo. Griffith and Mrs. Anna Brazee.

Highway Bids and Contract Awards for February and March 1946

February 1946

COLUSA COUNTY—Between 3 miles north of Arbuckle and four miles south of Williams, about 3.3 miles to be graded and surfaced with plant-mixed surfacing on cement treated base and a reinforced concrete bridge to be constructed across Cortina Creek. District III, Route 7, Sections A,B. E. B. Bishop, Orland, $236,681; A. R. McEwen & C. M. Syar, Sacramento, $248,657; J. R. Reeves, Sacramento, $281,546; Parish Bros., Benicia, $311,069; Guerin Bros., South San Francisco, $370,261. Contract awarded to Harms Bros., Sacramento, $219,031.

EL DORADO COUNTY—Between Shingle Springs and 1¼ miles west of El Dorado, about 3.4 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 11, Section B. E. W. Elliott Construction Co., San Francisco, $289,798; J. R. Reeves, Sacramento, $290,599; Larsen Bros., Sacramento, $315,681; Guy F. Atkinson Company, South San Francisco, $345,330; E. B. Bishop, Orland, $348,661; Elmer J. Warner, Stockton, $349,518; A. Teichert & Son, Inc., Sacramento, $353,140; Piombo Bros. & Co., San Francisco, $360,256; Macco Construction Co., Clearwater, $363,143; Frederickson & Watson Construction Co., Oakland, $375,689; Louis Biasotti & Son, Stockton, $400,384. Contract awarded to Utah Construction Co., San Francisco, $260,925.

KERN COUNTY—At Freeman Gulch, a steel beam span bridge to be constructed and about one mile to be graded and bituminous treatment applied. District IX, Route 23, Section D. R. R. Hensler, Glendale, $110,007; Combs Brothers, San Leandro, $112,153; Vinnell Company, Alhambra, $112,572; Haddock-Engineers Limited, Oceanside, $128,680. Contract awarded to E. W. Elliott Construction Co., San Francisco, $79,807.

LOS ANGELES COUNTY—On Hollywood Parkway at Benton Way in the city of Los Angeles, a reinforced concrete overcrossing to be constructed. District VII, Route 2, Oberg Bros., Inglewood, $137,422; Mittry Bros. Construction Co., Los Angeles, $143,123; J. E. Haddock, Ltd., Pasadena, $159,669; Baruch Corp., Los Angeles, $164,866; Norman I. Fadel, North Hollywood, $214,828. Contract awarded to Byerts & Dunn, Los Angeles, $134,269.

SAN DIEGO COUNTY—In the city of San Diego, between "A" Street and 0.1 mile south of Mission Valley Road, about 2.9 miles to be graded and surfaced with Portland cement concrete pavement. District XI, Route 77. H. Earl Parker & N. M. Ball & Sons, Los Angeles, $1,121,672; E. W. Elliott Construction Co., San Francisco, $1,471,484; V. R. Dennis Construction Co., San Diego, $1,485,651; Basich Bros. & Basich Bros. Construction Co., Alhambra, $1,485,859; Griffith Co., Los Angeles, $1,488,864; Daley Corporation, San Diego, $1,552,130; Bressi & Bevanda Constructors, Inc., Los Angeles, $1,586,328; R. E. Hazard & Sons Contracting Co., San Diego, $1,758,891. Contract awarded to Mittry Bros. Construction Co., Los Angeles, $1,338,002.

SAN DIEGO COUNTY—A reinforced concrete overcrossing over Balboa Parkway at Richmond Street in the city of San Diego to be constructed. District XI, Route 77. Carroll & Foster, San Diego, $71,359. Mittry Bros. Construction Co., Los Angeles, $83,211; Haddock Engineers, Ltd., Oceanside, $96,793. Contract awarded to M. H. Golden Construction Co., San Diego, $62,053.

SAN JOAQUIN COUNTY—About six miles east of Tracy, two bridges to be constructed, one a steel beam span bridge on concrete pile bents across Paradise Cut and the other a reinforced concrete slab bridge on concrete pile bents across Paraside Cut Overflow. District X, Route 5, Section B. Macco Construction Co., Clearwater, $122,715; George Pollock Co., Sacramento, $129,744; Kiss Crane Company, San Pablo, $134,538; A. Soda and Son, Oakland, $135,709; Chittenden & Chittenden, Auburn, $140,722; M.J.B. Construction Co., Stockton, $142,652; Fred D. Kyle, Pasadena, $143,898; Frederickson & Watson Construction Co., Oakland, $144,931; M. & K. Corporation, San Francisco, $151,818; Guy F. Atkinson Company, South San Francisco, $152,676; Bechtel Brothers-McCone Company, San Francisco, $158,205. Contract awarded to Stockton Construction Co., Stockton, $119,097.

SOLANO COUNTY—In the city of Vallejo, Waterfront Road, between Virginia Street and Santa Clara Street, about 0.3 mile to be graded and paved with asphalt concrete on crusher run base. District X, Parish Bros., Benicia, $29,611; E. A. Forde, San Anselmo, $30,367; E. E. Lowell, Vallejo, $30,918; A. G. Raisch Co., San Francisco, $30,919; Lee J. Immel, San Pablo, $31,558; J. Henry Harris, Berkeley, $38,529. Contract awarded to C. M. Syar, Vallejo, $27,494.

March 1946

ALAMEDA COUNTY—Between Warm Springs and Mission San Jose, and between Warm Springs and Centerville, about 8.3 miles, shoulders to be widened with imported borrow and surfaced with plant-mixed surfacing and penetration treatment. District IV, Routes 5 and 69, Sections C,A. Milo A. Browne, Palo Alto, $43,228; Warren & Drayer, Alameda, $48,181; Lee J. Immel, San Pablo, $48,705; Union Paving Co., San Francisco, $50,786; A. J. Raisch Paving Co., San Jose, $55,655; J. Henry Harris, Berkeley, $58,306; East Bay Construction Co., Oakland, $63,738. Contract awarded to A. S. Jones, Napa, $40,823.

ALAMEDA COUNTY—In Oakland, between Distribution Structures and Seventh Street, about 1.4 miles, to be widened with Portland cement concrete pavement, and existing pavement to be resurfaced with asphalt concrete. District IV, Route 69, Louis Biasotti & Son, Stockton, $136,170; Gallagher & Burk, Oakland, $142,204; Independent Construction Co., Ltd., Oakland, $147,991; Chas. L. Harney, San Francisco, $148,552; N. M. Ball Sons, Berkeley, $153,317; J. Henry Harris, Berkeley, $154,731. Contract awarded to Lee J. Immel, San Pablo, $135,659.

CONTRA COSTA COUNTY—Between Concord Avenue and 0.4 mile west of Ohmer Station, about 2.3 miles, to be graded and paved with Portland cement concrete. District IV, Routes 75,106, Sections E,Cnd,C. Frederickson & Watson Construction Co., Oakland, $210,606; Gunner Corporation, Pasadena, $219,231; Piombo Bros. & Co., San Francisco, $221,068; N. M. Ball Sons, Berkeley, $221,696; Louis Biasotti & Son, Stockton, $236,015; Chas. L. Harney, San Francisco, $244,888. Contract awarded to Guy F. Atkinson Company, South San Francisco, $209,469.

LAKE COUNTY—Between 1.2 miles north of Rodman Narrows Road and Route 15, about 2 miles, to be graded and surfaced. District I, Route 89, Section E. Piombo Bros. & Co., San Francisco, $179,509; M. J. Ruddy & Son, Modesto, $197,910; Frederickson & Watson Construction Co., Oakland, $208,408; Elmer J. Warner & Ted Watkins, Stockton, $209,243; Guerin Bros., South San Francisco, $210,408; A. Teichert & Son, Inc., Sacramento, $219,721; A. R. McEwen & C. M. Syar, Sacramento, $228,626; E. W. Elliott Construction Co., San Francisco, $239,208; Guy F. Atkinson, South San Francisco, $361,165. Contract awarded to Louis Biasotti & Son, Stockton, $159,978.

LOS ANGELES COUNTY—On Santa Ana Parkway over Ramona Parkway, Ramp 4 in the City of Los Angeles, two overhead crossings and retaining walls to be constructed. District VII, Route 2, Oberg Bros., Inglewood, $128,767; J. E. Haddock Ltd., Pasadena, $133,101; Norman I. Fadel, North Hollywood, $138,084; Griffith Co., Los Angeles, $142,721; Spencer Webb, Los Angeles, $149,685; Peter Kiewit Sons' Co., Los Angeles, $155,138. Contract awarded to The Contracting Engineers Co., Los Angeles, $127,632.

LOS ANGELES COUNTY—On Rosemead Blvd. between Huntington Drive and Colorado Street, about 1.1 miles to be graded and paved with asphalt concrete on cement treated base. District VII, Route 168, Section C. Vido Kovacevich Co., South Gate, $133,883; J. E. Haddock Ltd., Pasadena, $133,920; John S. Swigart Co., Torrance, $139,511; Guerin Brothers, Los Angeles, $139,905; Basich Bros. Construction Co. & Basich Bros., Alhambra, $145,321. Contract awarded to Griffith Co., Los Angeles, $128,126.

MONTEREY COUNTY—Between 2 miles south of Salinas and Salinas, about 1.9 miles to be graded, paved with asphalt concrete on cement treated base and on existing surfacing, and plant-mixed surfacing to be placed on the shoulders. District V, Route 2, Section B. Frederickson & Watson Construction Co., Oakland, $243,650; Louis Biasotti & Son, Stockton, $248,740; Union Paving Co., San Francisco, $249,943; A. Teichert & Son, Inc., Sacramento, $261,578. Contract awarded to Granite Construction Co., Watsonville, $227,373.

In Memoriam

Roland Harrison Lapp

THE Division of Highways, Department of Public Works, deeply regrets the tragic accidental passing of Roland Harrison Lapp on the morning of February 25, 1946 at the age of 58.

"Pop" Lapp as he was known to his many friends and associates was active in highway construction from 1921 until his retirement in 1944. Upwards of 100 miles of exceptionally good pavements will bear testimony to his skill for years to come. An excellent teacher, "Pop's" presence will be felt in construction for as many years as his assistants remain in the field.

Born in Elyria, Ohio, August 8, 1888, he came to California in 1906. He worked for the Southern Pacific Railway on the double-track from Rocklin to Sparks; for the Placer County Surveyors Office; during World War I he was aircraft machinist in an Oakland plant. In 1921 he went to work for the State and remained there until his retirement.

He is survived by his wife, Norma; sons, Fred, Clarence, Norman, and Harold; daughters, Dorothy, Nell, Eileen, and Clara; and grandchildren, Terry and Linda.

In Memoriam

Rex J. Allan

IN the passing of Rex J. Allan on March 5th, at Glendale, District VII of the Division of Highways not only lost one of its most valuable employees but one of the most beloved and highly esteemed men in the organization.

Mr. Allan was employed continuously by the Division of Highways in District VII and the Headquarters Laboratory from 1932 until the time of his death, with the exception of the time spent in the Army during the recent war. He was appointed to the position of District Materials Engineer in District VII in 1938 and under his supervision the District VII Laboratory at North Hollywood was organized and has grown into one of the most important branches of the Headquarters Laboratory.

Mr. Allan was born January 2, 1899, at Grand Island, Nebraska, and completed his education at the Colorado School of Mines. Shortly after completing his education he entered the employ of the Montezuma Copper Company, Sonora, Mexico, and served with that company and several other mining companies in the capacities of engineer, construction superintendent, and chief engineer until 1931.

Shortly after the recent war started, Mr. Allan, who was a World War I veteran, entered the service as Captain, Corps of Engineers, and served on the Pan-American Highway in Costa Rica as Chief of the Engineering Division of the San Jose area. On the suspension of work on that highway, he was transferred to continental United States where he served as Chief of the Engineering Division of the Seattle Engineering District, where he was promoted to the rank of major. At his own request he was transferred to active service in the Asiatic area, serving in the Philippines as Chief of the Testing Branch of the Engineering Construction Command, where he was promoted to the rank of lieutenant colonel, and later in Japan with the Army of Occupation.

Mr. Allan resumed his work in District VII on February 21, 1946, shortly after his release from the Army.

All who came in contact with Mr. Allan had the highest regard for him, both personally and professionally. His many years of efficient and loyal service won many friends for him and for the State.

He is survived by his widow, Mary A. Allan, a sister, Elsie Allan Tompkins, and a brother, Leo G. Allan.

Bridge Maintenance Practice On California Highway System

(Continued from page 24)

Vinsol in the field. It is prepared in both a powder form and solution.

Darex AEA is water soluble and may be either interground with the cement or added at the mixer.

Under normal conditions, around 0.02 per cent of the agent, in a solids form, by weight of the cement, is required for air entrainment.

The advantages claimed for air-entraining cement may be summarized as follows:

(1) Increased durability.
(2) Improved workability and plasticity.
(3) Reduced bleeding, segregation and laitance; providing greater uniformity.
(4) Reduction in water and sand content. This partly compensates for sacrifices in density due to air dispersion.

(f) CONCLUSION

In conclusion, it may be stated that further studies of the general problem of weathering will be continued in an endeavor to obtain a solution of it. Methods of repair discussed under "Repair of Deteriorated Surfaces" will be pursued further. It is also planned to use air-entraining cement in concrete for replacement of existing curbs and railings which have disintegrated beyond practicable repair. Laboratory research and field work will be coordinated to obtain maintenance and construction procedure resulting in adequate protection for concrete structures at high altitudes.

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In Memoriam

Albert Hardell

DISTRICT V personnel learned with regret of the death of Albert Hardell, "Mike," as he was known to his fellow employees, who passed away at the age of 45 after having been confined to the Santa Cruz sanatorium more than a year.

Mike's home-town region was Santa Cruz where he attended high school. His earlier work found him as a donkey engineer in the lumber work around Santa Cruz and later on survey parties in the San Francisco Bay region.

He came to work for District V of the Division of Highways as a rodman in June, 1930, and remained in that district until his death. While in the district, he served in the varied capacities of field office man on surveys and construction, inspector on construction and in the district office.

He is survived by his sister, Mrs. F. T. Smith of Santa Cruz, California.

Ancient "Weather Map"

(Continued from page 28)

new streams cut deeper and deeper into the soft materials and where they crossed their former locations, as they often did, the gravels and the gold were reconcentrated in the beds of the later rivers. The forests also crept slowly back over the broken landscape.

Following this period came the latest major alteration in the topography of the Sierras. Most of the mountain mass tilted as a unit; the eastern edge of the block moved upward along the line of an ancient fault so that now when one crosses the mountains from west to east in the region now under consideration one finds a long fairly uniform gradient upward for 50 miles or more and then comes the sudden drop-off, a nearly vertical descent of more than a thousand feet.

This increase in the gradient of the streams that ran directly down the western slopes of the range added greatly to the erosive action of the water in them and resulted in their cutting the deep and narrow V shaped canyons that we see today. High up on these canyon walls, sometimes 2,000 feet above the water level in the stream below and frequently cutting directly across the course of the present stream we find exposed an old river channel of Tertiary times.

One of these is our ancient "weather map."

All in Day's Work

February 12, 1946

The Superintendent
California Highway
Maintenance Department,
Bishop, Calif.

Dear Sir: The purpose of my writing you is to inform you of the most excellent assistance given my wife and self and our car yesterday on Towne's Pass.

A sudden blizzard caught us near the top and Foreman Dominik Wiget and his two helpers spent over three hours yesterday in the snowstorm, to come up to us (two miles from the top) to free our car and bring us safely back to Panamint.

It is entirely due to their untiring devotion to duty that I am able to write to you today and express our gratitude and admiration for their unselfish and splendid service.

Unable to compensate them in any way, I felt I had to bring this to your attention.

Yours very truly,

Victor B. Cranley
240 Central Park South
New York 19, N. Y.

Road Builders Pay High Honor To O. J. Porter

THE American Road Builders Association has honored Mr. O. J. Porter, Senior Testing Engineer, Materials and Research Laboratory, Division of Highways by appointing him Vice President of the Western District of the Airport Division of the Association.

Mr. Porter entered the employ of the Division of Highways in June, 1924. During the first four years of his service he was engaged in general testing work on all types of road materials in the Materials and Research Laboratory. For the last 18 years he has specialized in the study of foundations and in research and testing of soils and aggregates under the supervision of the Materials and Research Engineer. At the present time Mr. Porter is a Senior Testing Engineer.

Mr. Porter developed the method for determining the Maximum Compaction and Optimum Moisture of soils in 1929. This method has since become more or less standard practice among engineers throughout the world. In 1931 he developed the California Bearing Ratio Test which was subsequently adopted by the United States Army for use in the design of airfield pavement during the war.



Super-Highway to Paris Nears Completion

THE new super-highway, which is to provide a far more direct and speedy link between Paris, Brittany and Normandy, is now nearing completion, in France.

This new route is part of a general highway plan laid out back in 1935 when French engineers tackled the problem of supplanting certain picturesque but narrow roads with miles of broad, modern highways. To minimize traffic congestion in the Paris area, the old St. Cloud bridge, which dates back to 1566, has been made over and a 60-foot-wide vaulted tunnel has been cut through the St. Cloud Hill to permit the passage of a large volume of traffic without marring the beauty of the famous park. At Rocquencourt near Versailles, a clover leaf intersection of six one-way lanes will keep converging traffic running smoothly.

State of California

EARL WARREN, Governor

Department of Public Works

Headquarters Public Works Building, Twelfth and N Streets, Sacramento

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C. C. CARLETON, Chief
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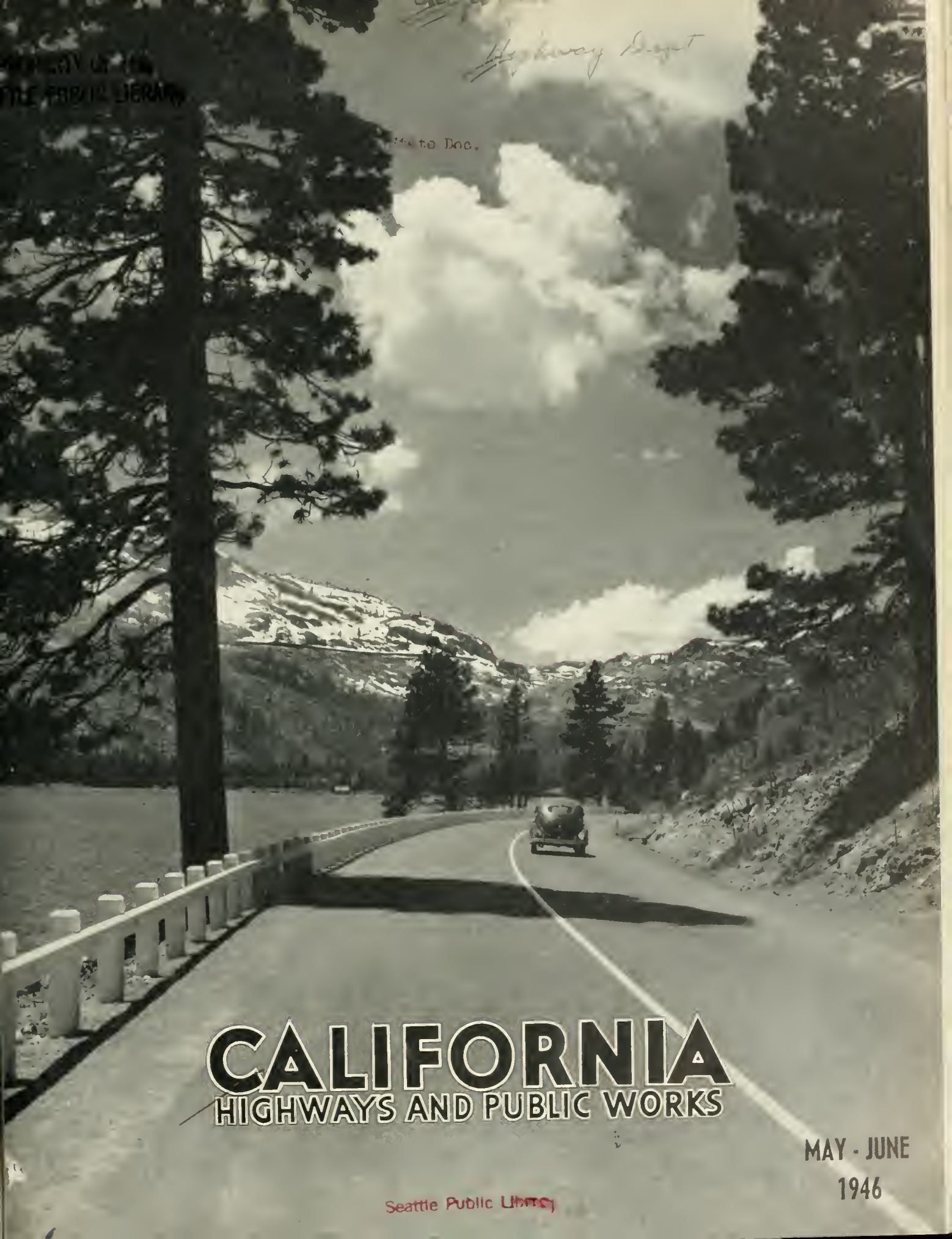
CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES
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~ LEGEND ~
Primary Routes
Secondary Routes
Proposed Routes



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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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State Government Moves to Solve Critical Lumber Shortage Problem

A Forest-to-Market Conference was held in Sacramento May 13th at the call of Governor Earl Warren. Its purpose was to find ways and means for bettering highway transportation facilities in lumber-producing counties of Northern California.

Pursuant to the expressed wish of the conference, engineers of the Division of Highways are completing studies on each of some 30 mountain roads and highways designated by the conference as bottlenecks to the movement of lumber urgently needed to alleviate the housing shortage, particularly as it affects veterans' needs.

A report and recommendations on the findings of the Division of Highways will be submitted by State Highway Engineer George T. McCoy to the California Highway Commission at its meeting on June 19th.

Members of the commission will see for themselves some of the road bottlenecks in lumber areas to which attention was called at the Forest-to-Market Conference. The commissioners will leave Sacramento on Wednesday, June 19th, for a seven-day tour through Tehama, Shasta, Siskiyou, Trinity, Modoc, Lassen, Plumas, and Butte Counties.

The commission is particularly interested in U. S. 299 from Redding through Douglas City in Trinity County to Arcata in Humboldt County. It already has appropriated approximately $600,000 to improve a hazardous section of this route from Old Shasta to Schilling.

Thereafter, as requested by Governor Warren, the commission, headed by Director of Public Works C. H. Purcell, and McCoy and his engineering staff will meet with representatives of the U. S. Public Roads Administration, the U. S. Forest Service and the Division of Forestry, Department of Natural Resources, to jointly explore the problem involved, especially as it relates to the raising from all available and potential sources of funds which will be required to immediately improve or expand highways carrying lumber traffic.

Meanwhile the U. S. Public Roads Administration is rushing to completion two forest highway projects on State Route 25, between Nevada City and Downieville and on U. S. 50, the Placerville-Lake Tahoe route.

During 1944 approximately 10,000,000 board feet of timber moved over Route 25 and approximately 71,000,000 board feet of logs and lumber were transported over U. S. 50.

The contract for widening and realigning 3.64 miles of the Nevada City-Downieville highway between the Middle Fork of the Yuba River and Wilson's Cabin was awarded September 18, 1945, to H. Earl Parker of Marysville. The amount of his bid was $390,210.10. Work started October 9th with a contract time of 300 days. The project is about 66 per cent complete. The highway is being built to a 26-foot paved width with a 7 per cent maximum grade and 200-foot radius of curvature.

On U. S. 50, a section 3.1 miles in length is being realigned between Fresh Pond and Pollock Pines. This contract also was awarded to Parker on March 13, 1946, on his bid of $470,032.50. Work started March 26th with a contract time of 250 days. The project is about 7 per cent complete. The highway is being constructed with two 11-foot surfaced lanes and 5-foot oiled shoulders over most of the distance with additional widths in two sections to facilitate passing loaded trucks on adverse grades. The maximum grade is 7 per cent with a 700-foot minimum radius of curvature.

In attendance at the Governor's conference were representatives of U. S. Public Roads Administration, the United States Forest Service, State Department of Public Works, California Highway Commission, Department of Natural Resources, State Board of Forestry, members of boards of supervisors and other spokesmen from 17 lumber producing counties, members of the Joint Legislative Interim Committee on Highways, Streets, and Bridges, the Senate Interim Committee on Forestry, the District Forest Practices Committee, the Citizens' Advisory Committee on Development of Natural Resources, the Home Building Committee of the Reconstruction and Reemployment Commission, and representatives of the lumbering and trucking industries of California.

Among the speakers were Ronald Campbell of the David D. Bohannon Organization, San Mateo; Regional Forester S. B. Show, U. S. Forest Service, San Francisco; C. C. Morris, Division Engineer, Public Roads Administration, San Francisco; C. H. Purcell, Director of Public Works and Chairman of the Highway Commission; E. Guy Warren, President California Truck Owners' Association; W. R. Schofield, California Forest Protective Association; Congressman Clarence F. Lea, Santa Rosa; George B. McLeod, President Hammond Lumber Company; E. J. Regan, District Attorney of Trinity County; Senators George M. Biggar, Covelo; Oliver J. Carter, Redding; Louis Sutton, Colusa, Frank L. Gordon, Napa County, and H. E. Dillinger, Placerville, and Assistant State Highway Engineer Fred J. Grumm.

Addressing the Forest-to-Market Conference, Governor Warren summarized the purpose of the meeting in the following words:

MAJOR POSTWAR PROBLEM

"One of California's major postwar problems is the lack of adequate roads and highways in the forest areas for the transportation to market of lumber urgently needed to relieve the present housing shortage.

"I have requested you to attend this conference because I hope that through discussion of the situation we can work out at least a partial solution.

"How the flow of sorely-needed lumber from forest to market may best be speeded up is a matter that vitally affects each and every one of you. It affects the State and Federal agencies and political subdivisions and private industry which you represent.

"I think we should confine ourselves today only to emergency proposals which if acted upon immediately will result in more lumber being made available for use in home construction, particularly for veterans, later this year or early next year.

CONCERNED OVER VETERANS

"I am especially concerned and I am sure that all of you are, over the



New forest highway between Fresh Pond and Pollock Pines on U. S. 50 takes shape

desperate situation in which our veterans find themselves, with regard to housing for themselves and their families. We have done everything within our power to facilitate the acquisition of homes by veterans.

"We have reduced the interest rate on veterans' loans from 5 per cent to 3 per cent and increased the maximum loan limit from $5,000 to $7,500 on homes and from $7,500 to $15,000 on farms.

"We have submitted to the people of California a $100,000,000 veterans' bond act which will be on the November ballot.

"We are now engaged in administering a $30,000,000 bond issue for

(Continued on page 31)



Heavy rock excavation in progress on realigned section of State Route 25



Section of new highway between Nevada City and Downieville—old route follows hazardous curve above new road



Looking from Windmill Hill toward Shingle Springs, showing clearing and old pioneer grading. Existing highway in middle ground

Eliminating 29 Curves on U. S. 50 Between Shingle Springs and El Dorado

By SCOTT H. LATHROP, Assistant Highway Engineer

MODERNIZATION of the portion of U. S. Route 50 between Sacramento and Lake Tahoe was advanced another step in March of this year when construction was started on a project extending from Shingle Springs to 1¼ miles west of El Dorado.

In addition to being a link in one of the two mid-state major transcontinental highways, this section of road serves not only an extensive lumber industry but is a scenic and recreational area which is considered to be one of the finest in California. Both the American River Canyon and the Lake Tahoe region are very attractive, as is attested by the thousands of vacationers who visit these localities each year.

During peacetime this road was kept open all year and as a result an increasing number of winter sports enthusiasts have availed themselves of the excellent facilities for such recreation which are to be found in this area.

In February, 1857, President Pierce approved a congressional appropriation of $300,000 for a wagon road from Fort Kearney, via South Pass of the Rocky Mountains and Great Salt Lake Valley to the eastern boundary of California, near Honey Lake.

Immediately, Californians set to work to raise funds for a road over the Sierra to meet the projected Federal road at Honey Lake. On May 11, 1857, representatives of Sacramento, El Dorado and Yolo counties met in Sacramento. Twenty thousand dollars were subscribed by Sacramento, an equal amount by El Dorado and $10,000 by Yolo.

Finally in November, 1858, the road linking Sacramento and Placerville with Carson Valley was completed and now, with changes made through the years, is known as U. S. 50.

The section of road which is now being improved lies in rolling foothill country. When the highway was built in 1915 the traffic was much lighter than now and maximum average driving speeds were very much lower. In accordance with the standards applicable to those conditions, the original pavement width was only 12 feet and many of the horizontal curves used had radii as short as 100 or 200 feet. During the succeeding years the width of the pavement was increased by the addition of borders on both sides and the sharp curves were eased where feasible. Due to alignment controls and other limiting factors, however, complete adaptation to modern traffic requirements was impossible without reconstruction such as is now being undertaken.

The reconstruction of this project is on revised alignment throughout and makes a saving in distance of 0.4 mile. **Where the old road had 35 curves with a total central angle of over 1020 degrees the new alignment has only 6 curves, with a total central angle of slightly less than 142 degrees.**

(Continued on page 11)

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DONNER PARTY CENTENNIAL

By THOS. E. STANTON, Materials and Research Engineer

THIS year marks the centennial of the arrival at the eastern base of the Sierras of the emigrant party, originally designated the "Reed-Donner Party" but subsequently called the "Donner Party" after the selection, en route, of Geo. Donner as captain.

It was 28 years ago, on June 6, 1918, that the imposing monument to the pioneers and the Donner Party, on the shore of Donner Lake, was dedicated.

The Donner party left Independence, Missouri, on May 12, 1846, but the last of the survivors did not reach Sacramento (New Helvetia), until the spring of 1847, almost a year later.

Delays for one reason or another occurred all along the line, with the result that the bulk of the party did not arrive at the eastern foot of the Sierras until late in 1846 after early winter snows had acquired considerable depth, thus hampering the progress of the party which included quite an appreciable percentage of children.

The winter of 1846-47 was exceptionally severe and the snowstorms so frequent and heavy that the inexperienced emigrants were not only unable to make their way over the mountains to Sacramento, but also unable to secure enough food, through shooting or trapping, to properly sustain life, with the result that out of a total of 81 who encamped for the winter at various spots between a point on Alder Creek just east of Truckee and the easterly end of Donner Lake, where the Pioneer (Donner) Monument now stands, 36 perished during that winter, either in camp or in an attempt to get through to the Sacramento Valley and bring help to the rest of the party.



Pioneer (Donner) Monument. The inscription on the plaque reads "VIRILE TO RISK AND FIND; KINDLY WITHAL AND A READY HELP, FACING THE BRUNT OF FATE, INDOMITABLE—UNAFRAID"

DONNER LAKE DISCOVERED

At the time of the dedication of the monument in 1918, one historian recited that:

"So far as any record is preserved, this beautiful body of water (Donner Lake) was discovered by the Elisha Stevens Emigrant Party in November, 1884, and named Mountain Lake, and the first person to tarry there for any length of time was the late Moses Schellenbarger, father of Mrs. Margaret Schellenbarger - McNaught, Commissioner of Elementary Schools of the State of California."

A cabin was built in which Schellenbarger spent the winter of 1844-45. It is recorded that the cabin was left standing and that it was therein that some of the members of the Donner Party took refuge in November, 1846.

In June, 1847, the Schellenbarger cabin and all of the miserable huts which sheltered the members of the Donner Party, were burned by order of General Kearney, who passed that way with a small detachment.

The tragedy gave its name to Donner Lake and to Donner Pass where the main transcontinental highway, Route No. 40, and the main line of the Southern Pacific Railroad cross the Sierras.



Governors of two States attended the dedication of the Pioneer (Donner) Monument June 6, 1918. Left to right—Governor Emmett Boyle of Nevada, Martha Jane (Little Patty) Reed-Lewis, Eliza P. Donner-Houghton, Frances E. Donner-Wilder, Governor William D. Stephens of California

START OF EMIGRATION TO CALIFORNIA

Two years before the discovery of gold and while this region was still under the jurisdiction of Mexico, there was heavy emigration to California in 1846. This emigration was stimulated by congressional publication and distribution of 10,000 copies of Fremont's famous topographical reports and maps. The reports described his overland exploration trip to Oregon and California in 1843-44 under the guidance of Kit Carson and other pioneer trappers and guides.

As Mrs. Eliza P. Donner-Houghton states in her book on the "Expedition of the Donner Party": "The commercial world was not slow to appreciate the value of those distant and hitherto unfrequented harbors. Tales of the equable climate and marvelous fertility of the soil spread rapidly and it followed that before the close of 1845, pioneers on the western frontier of our ever expanding republic were preparing to open a major route to the Pacific Coast."

1846 HISTORIC YEAR

Phil Townsend Hanna in his excellent handbook of memorable historical data, "California Through Four Centuries," refers to the years 1846 and 1847 as the period of "Manifest Destiny," and Bernard De Voto calls 1846 "The Year of Decision."

On May 13, 1846, President James K. Polk proclaimed that by the act of the Republic of Mexico, a state of war existed between that government and the United States. The result was the American conquest of California and Texas.

The year 1846 has likewise been designated as "Bear Flag Year" in commemoration of the fact that on June 14th of that year the Bear Flag, standard of "The California Republic," was raised over the Plaza at Sonoma.

No effort will be made in this brief article to trace the course of these historical events. Suffice to say that 1846 marks the start of an era in California, the culmination of which is still undiscernible.

STATE HIGHWAY SYSTEM LAUNCHED

It is fitting, therefore, that we should this year celebrate the centenary of the genesis of this era, as well as commemorate the tragedy of the Donner Party.

In 1918 all highways across the Sierras, including the Truckee (Donner) Pass Highway, were relatively unimproved. They were narrow, single lane in many places, crooked, steep and unoiled, although it is true that starting with the last decade of the last century, the California State Legislature had initiated the policy of taking over a number of trans-Sierra highways, declaring them State highways and placing them under the jurisdiction of the State Engineering Department. There were in those days no automobile license fees or gasoline taxes, and funds for improvement or maintenance of State roads were limited to small legislative appropriations made at the biennial sessions.

The first bond act for the improvement of a coordinated State Highway System was voted in 1909 and the first money became available in January, 1912. The work on the system of highways contemplated by the bond act was placed under the direct jurisdiction of a special commission (the California Highway Commission) and a State Highway Engineer, independent of the State Engineer. However, the legislative act State roads continued under the jurisdiction of the State Engineer until 1917, when the Legislature of that year transferred

urisdiction over all such roads to the tate Highway Commission. The road o Lake Tahoe via Donner summit was ne of these roads.

Part of the writer's duties with the tate Highway Department at that ime, included supervision of highway ork in that territory, and in connecion with this work he was present at he ceremonies at Donner Lake on June , 1918, when the monument to the ioneers and the Donner Party was edicated.

Although the grandson of a "49'er," hen in 1894, as a boy, the writer atended the funeral of Pio Pico, aged 5, the last Mexican Governor of Calirnia, and gazed on his face as he lay his coffin, he had little appreciation f the historical significance of that vent. The dedication of the Pioneer Donner) Monument however, roused an interest in Californiana hich has never waned and it was nerefore, with keen interest that on une 6, 1918, over 70 years after the ragedy which has become an epic in alifornia, the writer attended the unveiling of the monument at Donner ake, near Truckee.



Three survivors of the Donner Party who were present at the dedication of the Donner Monument, left to right—Martha Jane (Little Patty) Reed-Lewis, Mrs. Eliza P. Donner-Houghton, Mrs. Frances E. Donner-Wilder

The unveiling of this monument was the culmination of 10 years of construction by the Native Sons of the Golden West, which was initiated in 1908, but which, although the corner stone was laid in 1910, was slowed down by World War I which was in its last stages when the monument was finally finished and dedicated.

SURVIVORS ATTENDED CEREMONY

Of the eight survivors of the party still alive in 1918, three attended the unveiling; Mrs. Martha Jane (Little Patty) Reed-Lewis of Santa Cruz; Mrs. Eliza P. Donner-Houghton of Los Angeles; and Mrs. Frances E. Donner-Wilder of Byron, the others being prevented from attendance by infirmities incidental to their age.

All survivors of that date have subsequently passed away, the last, Mrs. Margaret Isabella Breen-McMahon died in San Francisco in 1935 at the age of 89. Mrs. Leanna Charity Donner-App was 95 years old when she died in 1930. Mrs. Elitha C. Donner-Wilder and Mrs. Naomi L. Pike-Schenck were over 90.

Pictures taken at the dedication led to some interesting correspondence, particularly with Eliza Donner (Houghton) the youngest of the Donner girls.

Eliza Donner on October 10, 1860, at the age of 17 married S. O. Houghton. Houghton served as a colonel during the Civil War and from 1871 to 1875 as a member of Congress from that part of California extending from San Francisco to Mexico. He is reported as having secured during this period, the first Federal appropriation for the improvement of Los Angeles Harbor.

The family subsequently settled in Los Angeles where Mrs. Houghton was

(Continued on page 32)

Two pictures of Leanna Donner (Mrs. John App) at the age of 83 years, taken at er home near Jamestown, Tuolumne County in October and November, 1918. These notographs taken by the author were the first for which Mrs. App had posed since she as a girl. Concerning the picture on the left, Mrs. App's daughter, Mrs. R. Burrell, rote to Mr. Stanton: "I am very sorry I did not have mother change her dress. When ou come this way again, mother says you can take another picture of her in another ress. Her face is well taken but that dress is killing."





Improvements in Methods of Asphalt Subsealing of Concrete Pavements

By H. L. COOPER, Assistant Maintenance Engineer

STABILIZING concrete pavement slabs in California by the use of semifluid soil-cement mixtures forced under the slab, using equipment especially designed for the purpose, was first undertaken in 1931 and continued for five years thereafter. At that time the method was used to level up areas where the pavement had settled due to subsidence of the subgrade. This method was commonly referred to as "mud packing."

Nothing further was done in this class of work until 1943 when the practice was again adopted following the failure of concrete pavements at certain locations as a result of the increase in volume and weight of heavy truck traffic. These failures were largely caused by the concentration of traffic from war industries and resulted in a very rapid increase in both the distribution and rate of pumping at the joints in concrete pavements.

Surface water penetrating the cracks and joints saturates the subgrade and heavy traffic causes a pumping action that forces water and subgrade material up through these openings. This pumping action creates a cavity underneath the pavement at the joint and the necessary uniform subgrade support is lost. The pavement then acts as a cantilevered beam at cracks and joints where pumping occurs and breaks down under traffic.

AIR BLOWN ASPHALT

In 1944 and 1945 a few districts experimented with semi-solid asphalts instead of the soil cement mixtures. Asphalt, when heated to 350 degrees to 400 degrees F., flows like water and spreads more evenly under the pavement than the soil cement mixtures. Air blown asphalt having a penetration of 50-60 and 30-40 was first used, but it was found during the summer months that extrusions of the asphalt occurred from the joints and cracks, causing an unsightly appearance on the pavement. A higher melting point air blown asphalt with a penetration of 20-30 was then tried, and it was found that no more extrusions occurred.



Asphalt subsealing crew of Division of Highways at work

The results were so much more successful than the various types of soil cement mixtures, it was decided to use air blown asphalt this year where this type of work was necessary.

It is thought that one of the principal reasons for the success of asphalt is the fact that it forms a tight seal beneath the pavement and thus prevents the entrance of surface water. Its stability is not affected by water which may reach it through the subgrade or by percolation through the joints.

PROGRAMS SET UP

This spring, eight districts have "asphalt subsealing" programs set up in the total amount of about $100,000. Work was started on a section of the Ridge Route in District VII the early

Asphalt subsealing crew placing nozzle in hole



part of March, and since then all of the other districts have started work.

From a field investigation small portions between the following locations showed pumping and rocking concrete slabs and stepped joints:

District II	North and south of Redding	US	99
	Dunsmuir to half mile north	US	99
	Weed to Gazelle	US	99
District III	Sacramento to Lincoln	US	99E
	Roseville to Newcastle	US	40
District IV	Cloverdale to Petaluma	US	101
	Napa to Vallejo	State Sign	29
	Petaluma to Ignacio	US	101
	San Jose to Redwood City	US	101
	San Jose to Gilroy	US	101
	San Jose to Milpitas	State Sign	17
	Warm Springs to San Leandro	State Rt.	S
	Richmond to Pinole	US	40
District V	Cuesta Grade to Santa Maria	US	101
	San Luis Obispo Co. Line to San Ardo	US	101
	Salinas to Prunedale	US	101
	Los Alamos to Las Cruces	US	101
	Carpinteria to Ventura Co. Line	US	101
District VI	Lebec to Grapevine	US	99
	Fresno to Madera	US	99
District VII	N. City limits Los Angeles to Kern Co.	US	99
	Oxnard to Los Angeles Co. Line	US	101
	Tustin to Galivan	US	101
	Newport Beach to Doheny Park	US	101 Alt.
	Seal Beach to Huntington Beach	US	101 Alt.
District X	North of Lodi to Turner Station	US	99
	Manteca to Mossdale	US	99
	Stockton to Mossdale	US	50
	Merced to Madera Co.	US	99
	Madera Co. Line to Arena	US	99
	Vicinity Rio Vista	State Sign	12
	Cordelia—south	State Sign	21
	Vallejo to Vacaville	US	40
District XI	Orange Co. Line to Oceanside	US	101
	Rose Canyon	US	101
	Torrey Pines Grade	US	101

Locations where surface blankets were to be placed this summer were treated first in order to stabilize rocking and pumping slabs and insure a firm base.

EQUIPMENT USED

Holes are drilled in the pavement with jackhammers and drills, powered by a portable compressor, usually a day's work ahead of the jacking operations. Some districts drill 1¼-inch holes, while other districts prefer 2¼ inch holes, depending upon the type of asphalt nozzle used. Asphalt heating kettles of varying capacities equipped with pressure pumps, metal hoses, and special nozzles, are used to pump the hot asphalt under the pavement. Some of the kettles are equipped with a reversible pump so that a small amount of asphalt may be sucked out of the hole immediately before removing the nozzle in order to minimize the quantity of asphalt extruding on the pavement. A two-ton truck is used to pull the asphalt kettles and another truck is required to haul the 100-pound asphalt cartons.

Three men are required in the drill crew, and from six to eight men in the asphalt crew.



Type of expanding nozzle used for asphalt subsealing

SEQUENCE OF OPERATION

Previous to asphalt subsealing operations and immediately after a rain, if possible, all pumping and moving slabs are marked with white paint to show the drilling crew the location of slabs to be drilled.

A hole is drilled through the pavement usually located about a foot or 18 inches ahead of the joint in the direction of travel and approximately in

Asphalt subsealing showing two-way valve



Supplemental or auxiliary nozzle and three-way valve on full circulating system



the center of the slab. However, the locations of holes are varied considerably according to the extent of slab cracking and stepped joints, and where experience has shown that the best results may be obtained depending on subgrade conditions. Where free water is encountered in the subgrade at the time of drilling, the holes are blown out with compressed air to remove all water.

The 20-30 penetration asphalt is heated to a temperature of from 325 degrees to 400 degrees F. The injector nozzle which is attached to a 1-inch hose from the asphalt kettle is driven into the hole. A small amount of sand is sprinkled around the hole so that any spillage of asphalt may be easily removed from the pavement.



Asphalt heating tank with 950 gal. capacity built by Headquarters Shop, Div. of Highways



Type of expansion nozzle used in subsealing, showing Ames dial in background

exudes through adjacent cracks or until the slab starts to raise. To determine when the slab first starts to raise, sand was sprinkled along the joints and when the sand started to crawl the flow of asphalt was stopped. This year an Ames dial, graduated to .001 inch, mounted on a frame, is being used to indicate to the nozzle operator when slab movements begin.

SAFETY PRECAUTION

Immediately after the nozzle has been withdrawn from the hole, a wooden plug is driven into the hole flush with the pavement, or a wooden stake is driven in temporarily to prevent hot asphalt from extruding. Later on the holes not plugged will be filled with cement grout.

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TWO TYPES OF NOZZLES

Two types of nozzles have been developed. District X built an expansion type nozzle using a 2-inch asphalt hose which is expanded by screw pressure, and which completely fills the hole. The other type is a tapered pipe nozzle which is driven into the hole, using paper or burlap as a gasket to secure a tight fit. Both nozzles have proven satisfactory, with the tapered driven nozzle a little easier to handle.

Asphalt pumping is then begun. Pumping pressures of from 20 to 40 pounds per square inch have been found to be entirely adequate in filling the void beneath the slab.

Using this low pressure, a man standing on the nozzle plate will hold the nozzle securely in the hole. The pumping is continued until the asphalt

Two hammers drilling holes for asphalt subsealing



Eliminating 29 Curves between Shingle Springs and El Dorado

(Continued from page 4)



Grading operations one-half mile east of Shingle Springs

The table below gives the comparative statistics for the old and new alignments.

	New alignment	Old alignment	Saving
Number of Curves	6	35	29
Total Central Angle	141° 56½'	1020° 44'	878° 47½'
Minimum radius	1,500'	100'	
Length of road	3.432 miles	3.832 miles	0.4 miles

The new construction will provide a 22-foot x 0.25-foot plant-mixed surfacing on a 23-foot x 0.42-foot crusher run base. A layer of imported borrow 0.5-foot thick will be used throughout the full length and at various locations where additional cover is required selected material varying in thickness from 0.5-foot to 1.0-foot will be placed.

The contract allotment for this project, including provision for supplemental work and contingencies, is $277,253.03. It is expected that work will be completed about Oct. 15, 1946.

This hazardous curve is typical of many on U. S. 50 which will be eliminated by realignment



HIGHWAY TREE MAINTENANCE

By E. S. WHITAKER, Assistant Highway Landscape Engineer

DURING the war years, State highway tree maintenance was restricted by loss of man power, most of which entered the armed forces. The district tree maintenance crews, not including ground forces, were reduced in personnel from 48 to 22 tree foremen and tree trimmers. It accordingly became necessary to restrict the operations of these crews to the performance of only the most necessary work, such as trimming to secure sight distance and clearance of the traveled way, the repairing of trees damaged by storms, the inspection of work performed under encroachment permit, and the maintenance of landscaped areas. It has been only recently in some districts that a crew of sufficient size could be assembled to work on large jobs for general restoration of prewar conditions.



Trimming operations under way on U. S. 101 south of Camarillo, Ventura County

Work of this character is now under way in District VII, north and south of Camarillo in Ventura County where a crew of one tree foreman, three tree trimmers and two groundsmen, with three trucks and drivers for cleanup work, started trimming operations in March on two long rows of Phoenix canariensis. Except for minor trimming for clearance, these trees had not been trimmed since 1941 and the great mass of dying and dead leaves, fruiting wood, and spathe hanging down around their trunks was unsightly, as well as restricting clearance to traffic.

Tree Foreman O. W. Marvel holding the improved saw handle developed by him. Note the spikes on the leaf at the lower center of the photo



Trimming work on this species of tree has offered problems of economic operation as well as hazard to the trimmers. Tree trimmers do not look forward to this work with much enthusiasm, and its high cost per tree includes, usually, time off for one or more men injured by leaf spikes. The lower pinnae of the huge leaves of these trees do not develop fully but form strong, sharp, stiff spikes from 8 inches to 12 inches in length. When trimming is done each year, or at the most every other year, the dying leaves can be cut off before they hang down and the spikes do not offer the same hazard to the trimmer that exists when the leaves are fully declined and it is necessary to work up underneath them for removal.

Tree Foreman O. W. Marvel, in charge of the tree maintenance work in the Ventura area, has devised a method of suspension for the trimmer during these trimming operations that has

Highway tree trimmer removing leaves from a palm tree and using the improved suspension device developed by Tree Foreman Marvel



greatly decreased the time necessary to trim each tree and reduced the hazard to the trimmer. It has been necessary previously to work from ladders, or from a belt and safety rope around the tree. Work from the ladder was slow, it being often necessary to climb up and down and shift the ladder several times to get around the tree. The trimming from a belt and safety rope is faster than from ladders but still offers obstacles that slow down the work, chief of which is the stubborn and disconcerting tendency of the safety rope to foul up among the old stubs—and always on the opposite side of the tree.

NEW DEVICE USED

The three tree trimmers working with Marvel are now using swing boards and waist belts slung from safety knots. Above each safety knot, two adjustable ropes are attached to two iron hooks. The hooks are fashioned in the form of a letter "L" from ½-inch round iron. At one end of the shank is an eye 1-inch inside diameter for the rope to be spliced or tied to; the shank is 14 inches by 16 inches in length, the bottom is 8 inches in length and the lip is 3 inches long; both throat angles are 45 degrees. The hook is placed over the upper side of the base of the leaf and between the first spikes and the tree trunk.

The 3-inch lip holds the hook securely in place but does not bind, so that its removal and resetting over another leaf base is an easy operation. A ladder is used to climb within reach of the lower leaves; the trimmer then fastens one hook over the base of a leaf on each side of his body and at about shoulder height and starts cutting. By shifting one hook at a time, he can trim right around the tree, dropping the leaves to one side and outside of the suspension rope. This eliminates the danger of dropping the leaves over the safety rope, as was previously done, and reduces to a minimum the hazard from back or side kick. Once in position, it is not necessary for the trimmer to climb down the tree and up again to another location and as a result, the work is speeded up.

IMPROVED SAW HANDLE

Mr. Marvel has also developed an improved type of saw handle that allows for faster cutting and lowers the fatigue factor. On this work, Fanno saw blades with the teeth set to cut on the pull stroke are used. A long handle, rather than a grip handle,

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Methods of Asphalt Subsealing of Concrete Pavements

(Continued from page 10)



Here is a subsealing crew with equipment

As a safety precaution, the nozzle operator and helper wear gloves, leggins, and plastic masks to prevent being burned with the hot asphalt. To date we have experienced no casualties of any consequence in this operation.

Two or more kettles are used on the work, one kettle being equipped with a pressure hose connected to the gear pump and to a three-way valve at the nozzle. A return line from the three-way valve to the kettle allows circulation of hot asphalt through the hoses and eliminates "freezing." Asphalt is circulated through the lines at all times, except when being pumped under pavement. The other kettles on the job are used for auxiliary heating of the asphalt which is transferred into the pumping kettle as needed.

The "bottleneck" to date on this type of work has been inadequate facilities for heating the asphalt. A well organized crew uses from 800 to 1,100 gallons of asphalt per day. The capacity of the heating kettles varies from 165 to 400 gallons, which necessitates stopping operations to pump asphalt from the auxiliary kettle to the pumping kettle four or five times per day, which results in a total loss in time of at least an hour.

In order to improve this condition, Headquarters Shop is now converting two 1,040-gallon water tanks into oil heating tanks complete with burners, oil pump and pressure hoses. The outfits will be capable of heating cold asphalt to 400 degrees and pumping directly under the pavement. These two units should materially increase production and reduce costs. Headquarters Shop also has on order several 400-gallon asphalt kettles complete with engines and pumps which will be used later by some of the districts in asphalt jacking.

We have been trying, without success to purchase hot 20-30 penetration asphalt directly from the refineries. At the present time it is only possible to purchase this grade of asphalt in 100 pound cartons.

Experience to date has shown that it is possible to pump some hot asphalt under all types of concrete pavement, the amount of asphalt varying from five gallons to as high as 15 gallons per hole. The average for several districts varies from seven to 11 gallons per hole. The number of holes filled or slabs treated varies in the districts according to the equipment used and the organization of the crew, but averages have been maintained in most of the districts of from 100 to 130 holes per day.

The total cost of this work per day, labor, equipment, and materials, averages from $260 to $280, or an average cost of $2.50 per hole. It is believed that when better equipment is secured and crews become more experienced the cost of this work will be materially reduced.

Experiments made and results obtained in "Asphalt Subsealing" will be contained in a later article.—Ed.

CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

San Rafael Arcangel
December 14, 1817

WITH the beginning of the nineteenth century the extraordinary number of deaths among Indians at Mission San Francisco de Assisi (Mission Dolores) greatly alarmed the padres at this Franciscan station and their fear of increased mortalities was communicated to Governor Pablo de Sola. While diseases brought to California by Mexican soldiers contributed largely to the death rate of Indians at all the missions, two severe epidemics of measles at Mission Dolores, the last one in 1806, did much to decimate the ranks of the neophytes at this station and on the San Francisco peninsula.

At last Governor Sola suggested that ailing Indians be transferred across the bay to what now is Marin County where a milder climate prevailed. As an experiment, several neophytes were sent over and their health was greatly improved. Fr. Comisario Prefecto Vicente Francisco de Sarrio approved of the idea, but hesitated to permit large numbers of Indians to be moved to the Marin district because communication was difficult and missionaries were lacking.

However, says Fr. Engelhardt, mission historian, after several neophytes on the northern shore had died without receiving the Last Sacrament, Fr. Sarria sought a way out of the dilemma. At this time there was at Mission Purisima Concepcion the learned Fr. Luis Gil y Taboada, who was versed in medical science. Hearing of the situation confronting Fr. Sarria at Dolores, Fr. Luis offered to reside at Dolores as a supernumerary and from there to attend the sick across the bay.

MISSIONARY HOSPITAL

The offer of Fr. Luis was accepted and this move resulted in the founding, on December 14, 1817, of a missionary ranch in Marin under the patronage of St. Raphael, the Arcangel. Here was erected a chapel and baptistry and a cemetery was laid out. This was the beginning of Mission San Rafael.

Some 240 neophytes were transferred from Mission Dolores to the health farm and by the end of 1820 this number had been increased to 590. A composite building, including church, priest's house and all the apartments required was erected in 1818. It was 87 feet long, 42 feet wide and 18 feet high. The corridor was roofed with tules. No serious attempt ever was made to beautify the mission architecturally. It remained a church hospital. It was dedicated to St. Raphael "in order that this most glorious prince, whose name signified the healing of God, might care for the bodies and souls there."

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into northern Washington.

Present day State highways lead to all the mission sites.

The Division of Highways has published in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions were taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the eleventh and last of the series.

In 1821 rumors came to Governor Sola that some English or American adventurers had established themselves somewhere within 40 or 50 leagues north of San Francisco Bay. He determined to ascertain what truth was in the reports and sent out an expedition of 55 leather-jacketed soldiers and infantrymen under Captain Luis Arguello. Fr. Blas Ordaz accompanied the party as chaplain and chronicler.

EXPEDITION GOES NORTH

Fr. Engelhardt gives an interesting summarized account of the wanderings of the expedition which Historian Bancroft believes went as far north as Shasta, or Weaverville in Trinity County, and then struggled back through the mountains by way of Ukiah, Cloverdale, Healdsburg, Santa Rosa, and Petaluma to Mission San Rafael. Says Fr. Engelhardt:

"The whole company, joined by some Ululatos and Canucaymos Indians, who wished to visit their pagan relatives, set sail in the two launches of the presidio and the mission about 11 o'clock on the morning of Thursday, October 18, 1821, and landed near the estero of San Rafael, at Ruyuta, in the vicinity of what is now Point San Pedro, where they passed the night. Next day they continued the voyage to Carquinez Strait where they were joined by two other boats. On Saturday the horses were ferried across the stream. On Sunday, the 21st, Fr. Ordaz celebrated Holy Mass, whereupon the troops and Indians passed over to the other side.

"The march north began on Monday and continued to October 30th up the valley of the Sacramento, which the Spaniards called Jesus Maria. Unfortunately, Fr. Blas gives no distances nor latitudes, so that it is impossible to locate the different Indian villages and camping places. The natives in but a few cases showed hostility, but the booming of the canon would disperse them. Only in one case Sergeant Amador, despite Arguello's orders, aimed low and killed seven of the aggressors. The most serious mishap to the soldiers was the loss of a mule that fell into the river with 2,000 cartridges on its back. Until the 30th



From Wash Drawing by H. Chapman Ford

Nothing now remains of Mission San Rafael Archangel depicted here in a wash drawing by H. Chapman Ford

Fr. Blas found little difficulty in conversing with the Indians, but from that date the Spaniards had to content themselves with the sign language.

WEARY MARCHERS RETURN

"On October 31st, the expedition departed from its northward course and turned to the west, according to Fr. Ordaz, until it came to the foot of a mountain range 15 leagues from the Sierra Nevada, which range extended from north to south and terminated in the region of Bodega, then in possession of the Russians. An Indian attack at night was repulsed by the explosion of a grenade. Next day after Holy Mass the return march was begun and continued southward over the mountains for nine days. No distances are given, so it is impossible to trace the route; but the explorers experienced great difficulties. Many horses died, and four pack mules fell down a precipice. On November 10th they found the body of a neophyte from San Rafael who had been killed by savages. After Christian burial had been accorded, the weary wanderers arrived at a spring which they named San Jorge. Next day, Sunday, Fr. Blas celebrated Holy Mass for the last time on the journey, as at about 6 p.m. they reached Olompali, six leagues from San Rafael. Worn out, and the rations nearly exhausted, the explorers arrived at San Rafael towards noon of the 12th. Here Fr. Blas next morning sang a High Mass in thanksgiving. In the forenoon of the 15th all had again returned to the presidio of San Francisco."

In 1821, the imperial commissioner, Rev. Agustin Fernandez de San Vincente decided to visit the Russian settlement at Fort Ross to gather information for his government. Fr. Commissary Prefect Mariano Payeras accompanied him. They left Monterey on October 11th, arrived at the presidio of San Francisco on the 18th and the following day, with a detail of soldiers, set out for Mission San Rafael, reaching there in the afternoon. On Sunday, October 20th, Fr. Payeras celebrated Holy Mass in honor of the patron San Rafael. Arriving at Fort Ross, they were received by Captain Carlos Schmidt and remained there two days. They returned to Mission San Rafael on October 26th. Fr. Payeras drafted a lengthy report describing Fort Ross and its settlement.

In April, 1823, Fr. Payeras died at Mission Purisima Concepcion and Fr. Jose Senan became presidente of the missions. He survived Fr. Payeras only four months, passing away in August, and Fr. Vicente de Sarria succeeded him.

One of the first matters to engage Fr. Sarria's attention was the unauthorized attempt of Fr. Jose Altimira of Mission Dolores to abandon the San Francisco station and Mission San Rafael and establish a new mission in Sonoma County. In this move, Fr. Altimira had the support of Governor Arguello. As we know, Fr. Sarria blocked the plan, but, nevertheless, permitted the Mission San Francisco Solano to be continued after its irregular founding by Fr. Altimira. The story of this intrigue properly belongs in the chapter dealing with Mission San Francisco Solano.

In 1824, an Indian named Pomponio, an outlaw who for several years had robbed and murdered Indians from San Rafael to Santa Cruz, was captured by Lieutenant Martinez near Mission San Rafael after he had killed

a soldier. He was sent to Monterey, tried and shot in September.

STORMY PERIOD

A stormy period in the history of Mission San Rafael is dealt with by George Wharton James, who wrote:

"When the northern Missions were placed under the padres from Zacatecas, Padre Mercado was sent to San Rafael. He was a self-opinionated man, who soon got into trouble with Commandante Vallejo of San Francisco. He demanded the surrender of a neophyte whom the guard had arrested in accordance with Vallejo's orders; and when the corporal of the guard asked for meat for his men, Mercado insultingly told him 'he did not furnish meat to feed wolves.' The corporal caused a sheep to be killed, and this rendered Mercado furious.

"A few months later a band of gentile Indians came to San Rafael, and during the night a robbery was committed. The padre accused 15 of the strangers of the theft, arrested them, and sent them to San Francisco. Fearful lest the whole band should then come down upon him for vengeance, he armed his neophytes and sent them out under the command of his majordomo to surprise the gentiles. The movement was a success from his standpoint, as 21 were killed, as many more wounded and 20 made captives, some of these latter being women and children. When the matter was reported to Governor Figueroa he was exceedingly indignant, especially as the padre asked for reinforcements to 'pacify' the rancherias. Mercado was suspended by his prefect, pending an investigation, while Vallejo, releasing the prisoners sent to San Francisco, also freed those in bonds at San Rafael, and then went among the rancherias, explaining the matter and doing his best to quiet the angry feelings aroused. In the middle of the following year Mercado was released and returned to San Rafael, two friars, who had been sent to report upon the matter, claiming he had nothing to do with the attack."

MISSION IS SOLD

On November 4, 1834, Governor Figueroa issued his decree secularizing the California Missions. San Rafael was designated as a curacy of the first class. Ignacio Martinez was named commissioner in charge. An inventory placed a value of $18,474 upon the mission buildings, church, ornaments and livestock. Debts were listed to the amount of $3,488, leaving a balance of $15,025. In December, 1,291 sheep and 439 horses were distributed among 343 mission Indians.



This church now stands on the original site of Mission San Rafael in the City of San Rafael

Old mission records show that in 1832 the station had 2,120 cattle; that it had its largest flock of sheep, 4,000 head, in 1822; its largest herd of horses, 454, in 1825, and that its largest wheat crop was in 1822 when 2,458 bushels were harvested.

In 1845, Governor Pio Pico had an inventory taken at San Rafael and the valuation of the mission and property was fixed at $17,000. The following year he sold the mission to Antonio Sunol and A. M. Pico for $8,000. The purchasers did not obtain possession. American occupation came and Mission San Rafael some years later was returned to the church by order of the President of the United States.

In June, 1846, John C. Fremont marched to meet a force of Mexicans believed to be at San Rafael. He did not encounter the enemy. On June 26th he took possession of the mission and remained there about a week. When he left he took a number of cattle and horses, went to Sonoma and on July 5th took active command of the conquest of California.

After Fremont's departure the mission fell into rapid decay.

From 1817 to 1845 there were no other habitations in San Rafael aside from the mission. In the latter year, Don Timoteo Murchy built the first house in San Rafael and later Jacob and J. O. B. Short erected the second structure. In 1854, a band of squatters seized the mission land, but were evicted by the government. In 1869 a

Catholic church was built on the old mission side. The altar space occupied the same position as did the altar of the mission. This church burned down and a new one was built in 1917. It stands on the old mission site at the head of "A" Street on Fifth in San Rafael. Adjoining is a parochial school. The only thing remaining of Mission San Rafael is an ancient pear tree. It is protected by a cement coping.

Motorists entering San Rafael from the north over U. S. Highway 101 who desire to visit the mission site will turn into the business district via Fourth Street and drive up Fourth to "A" Street where a Mission Bell sign will direct them one block north to the site.

Visitors coming from San Francisco will follow U. S. 101 into the city, turn west on Fourth Street to "A" Street and go one block north to Fifth Street, where is the mission site. Or the route may be west on Fifth Street to "A" Street.



From Original Etching by H. Chapman Ford

Mission San Francisco Solano as it looked during its occupancy by the Padres

San Francisco Solano
July 4, 1823

We come now to the end of "The Trail of the Padres."

Fifty-four years after Fr. Junipero Serra founded Mission San Diego de Alcala with visions of a chain of Franciscan stations stretching from San Diego to San Francisco, the Mission San Francisco Solano was established in what now is Sonoma County on July 4, 1823. It was the twenty-first and last of the California missions.

Because Fr. Jose Altimira, then at Mission Dolores, proceeded to found San Francisco Solano without the consent of his superiors it was nine months before the mission church was dedicated and the station officially began to function.

Fr. Jose Senan had succeeded Fr. Payeras as Presidente of the California Missions but, as we have seen, lived with his new honors only a few months and upon his death Fr. Vicente de Sarria became Presidente. The story of the irregular founding of Mission San Francisco Solano is best told by Fr. Engelhardt, mission historian, who wrote:

UNAUTHORIZED FOUNDING

"The first important matter which engaged the attention of Fr. Sarria was the unauthorized founding of a new mission in the north and the attempted suppression of the missions of San Francisco and San Rafael. The sterility of the soil, the severity of the climate, and the prospect of numerous conversions, appealed to Fr. Jose Altimira, a newcomer stationed at San Francisco, as sufficient reasons for removing his neophytes to a locality north of San Rafael. He found a sympathetic supporter of the plan in Governor Arguello, who until lately had been commander of the presidio on the bay. The proposition had been argued before Comisionado Fernandez and Fr. Prefecto M. Payeras during their visit in October, 1822. Fr. Altimira claimed that on this occasion Fr. Payeras had given his consent, and entrusted the petitioner, Fr. Altimira, with the transfer of the mission and the choice of a new site. This is scarcely possible, because the question could not be decided one way or the other without the approbation of the College of San Fernando. Nor would the late Fr. Comisario have determined the question without consulting the Fr. Presidente, because the other mis-



In its restored condition, Mission San Francisco Solano retains the architectural lines of the original establishment

sions usually had to contribute livestock, implements, and other goods. Certain it is, that the inexperienced and somewhat conceited young friar, at the instigation of Governor Arguello, Bancroft thinks, on March 23, 1823, drew up a memorial urging the transfer of Mission San Francisco. It was presented to the first Territorial Legislature at Monterey in April.

LEGISLATIVE ACTION

"The diputacion of legislative assembly of six men, who really had nothing to do with the matter, on April 9th not only voted in favor of the change, but decreed that the mission station of San Rafael should also be removed and with Mission San Francisco located on a new site in the country of the Petalumas or of the Canicaimos, in other words, that both should be suppressed and a new mission started. The diputacion went further, and proposed the suppression of the missions of Santa Cruz and San Carlos, but failed to agree. These measures were all beyond the province of the half dozen men who composed the assembly; for the missions were ecclesiastical institutions, under governmental protection, it is true, but not governmental establishments. At any rate, as Fr. Sarria remarked, the decrees had no binding force until approved by the Mexican Government, to which Arguello referred them next day.

"When Fr. Amoros of San Rafael heard of the resolution to suppress his post, where he was feeding, clothing, and instructing 800 Indian converts, he, on May 17th, sent a protest to Governor Arguello against the transfer which he declared unreasonable and unjust, in that the late Fr. Comisario-Prefecto, during his visit on October 19, 1822, had decreed that San Rafael in everything should be independent of Mission San Francisco. Nevertheless, without waiting for the approval of the Fr. Presidente, now that Fr. Payeras had passed away, Fr. Altimira with Francisco Castro, one of the six deputies, and 19 men under Ensign Jose Sanchez, embarked on June 25th for the purpose of establishing the proposed mission. They spent the night at San Rafael, and next day, set out to explore the country for a favorable site.

"They went by way of Olompali, examined the valleys of Petaluma, Sonoma, Napa, and Suisun, and finally on July 3d returned to Sonoma. Here they determined to locate the new establishment, because they thought the place best adapted by reason of its climate, abundance of timber, stone, and water. Fr. Altimira next morning raised and blessed the cross and site, celebrated Holy Mass, and thus on July 4th, albeit illegally, laid the foundation for the new Mission of San Francisco. 'All the people were told,' he writes highly elated to Fr. Senan, 'that in future this place would be called New San Francisco.' The expedition then returned to Mission Dolores where on July 16th the friar dated his diary and report.

FR. PRESIDENTE AMAZED

"The Presidente was amazed at the summary and illegal manner in which the legislative assembly had disposed of the subject of mission founding and mission suppression without consulting the Supreme Government in Mexico. He wrote to Fr. Sarria, he was fairly astounded at the audacity of Fr. Altimira. While he lay dying at San Buenaventura, Fr. Senan on August 14th dictated to Fr. Blas Ordaz a long letter full of minute instructions for Fr. Sarria. The document may be called his testament, for he died 10 days later. Concerning the transfer of Mission San Francisco, on account of

e roughness of the climate, he said at he was not averse to it, but that he nsidered the manner as striking at thority. For the rest he directed Fr. rria to do what he thought proper.

"After consulting with Fr. Estevan pis and Narciso Duran at San Juan autista, Fr. Vicente de Sarria ac-rdingly wrote to Fr. Altimira as llows: 'I have learned with regret hat Your Reverence has done in at-mpting to found the new Mission of n Francisco. By order of the Rev. r. Presidente Jose Senan, who is now grievously ill that he is incapaci-ted to govern the missions, I shall ave to act in his place in accordance ith his circular which has made the unds of the missions. Nevertheless, have not wished to take any steps ntil the subject was discussed in keep-g with our regulations. For this rpose various Fathers and myself ave assembled today at this mission. ecording to their judgment as well s mine, I have to say that Your Rev-rence is not lawfully authorized to ndertake said founding of a mission, nd that consequently you expose the piritual functions of your ministry to ullification, because the faculties hich we have are in locis a suis superi-ribus assignatis (for places assigned y their superiors). Such is the dec-aration of the Bull of Pius V on this oint.

"'Your reverence can not defend our action with the alleged will of the Rev. Fr. Prefecto, God rest his soul, which did not touch the present transaction of designating time and place, nor did it extend to the topographical site of the founding, or the sending of Your Reverence to such a distance without an associate contrary to canonical and civil laws and in opposition to the statutes of our Apostolic College. I do not know that there is among the Fathers one who approves of your way of proceeding. It will cause much grief at your college when it is informed about the matter. My dear Father, no one perhaps will surpass me in zeal for extending the glory of the Holy Name of the Lord by means of the light of His Holy Gospel; but Your Reverence knows that this zeal must be according to wisdom. If it must be against charity and its sweet fruit—peace, then let us put it aside or at least postpone it, the former for the sake of the latter which is more necessary.'

"Meanwhile, at the end of July, Arguello asked Fr. Altimira why he had not effected the transfer of Mission Dolores. He was told that it was impossible to begin operations without the neophytes of San Rafael, because the number of those at Mission San Francisco was not half sufficient. Fr. Altimira also went to Monterey, hardly with the permission of his prelate, to consult with the Governor. Arguello directed him not to await the Superior's orders, but to make a beginning at once.

"On August 4th, Arguello also sent communications of similar import to Fr. Presidente Senan, to Fr. Amoros of San Rafael, and to the commandante of the presidio of San Francisco. Strange to relate, Fr. Altimira on August 12th accompanied Lieutenant Ignacio Martinez across the bay, took possession of the mission property by inventory, and returned to Mission Dolores. On the 23d he started out for Sonoma with an escort of 12 men, who carried 500 cartridges, and artilleryman who was to manage a cannon of two-pound calibre, and a force of neophyte laborers. They arrived at New San Francisco on the 25th of August, and at once began work on a granary, irrigating ditch, corral, and other necessary structures. Good progress was made for a week, when on August 31st Fr. Sarria's letter just quoted changed the situation.

"Bancroft describes Fr. Altimira's state of mind after the receipt of Fr. Sarria's letter as 'furious.' The terms and tone of a long, wild communication which the self-willed young friar addressed to Governor Arguello on the same day justifies the word. Recounting what had occurred, and that he was obliged to interrupt the work, he complained most bitterly of the way in

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Old mission bell hangs at entrance to Sonoma Mission, now a State museum

Napa County and State Celebrate Progress on Rector Canyon Dam

HEAVY construction work on Rector Canyon Dam in Napa County was inspected on Saturday afternoon, May 11th, by Governor Earl Warren, State, Federal, and county officials and members of the Legislature who made the project possible. They participated in ceremonies celebrating the start of placing the fill in the dam.

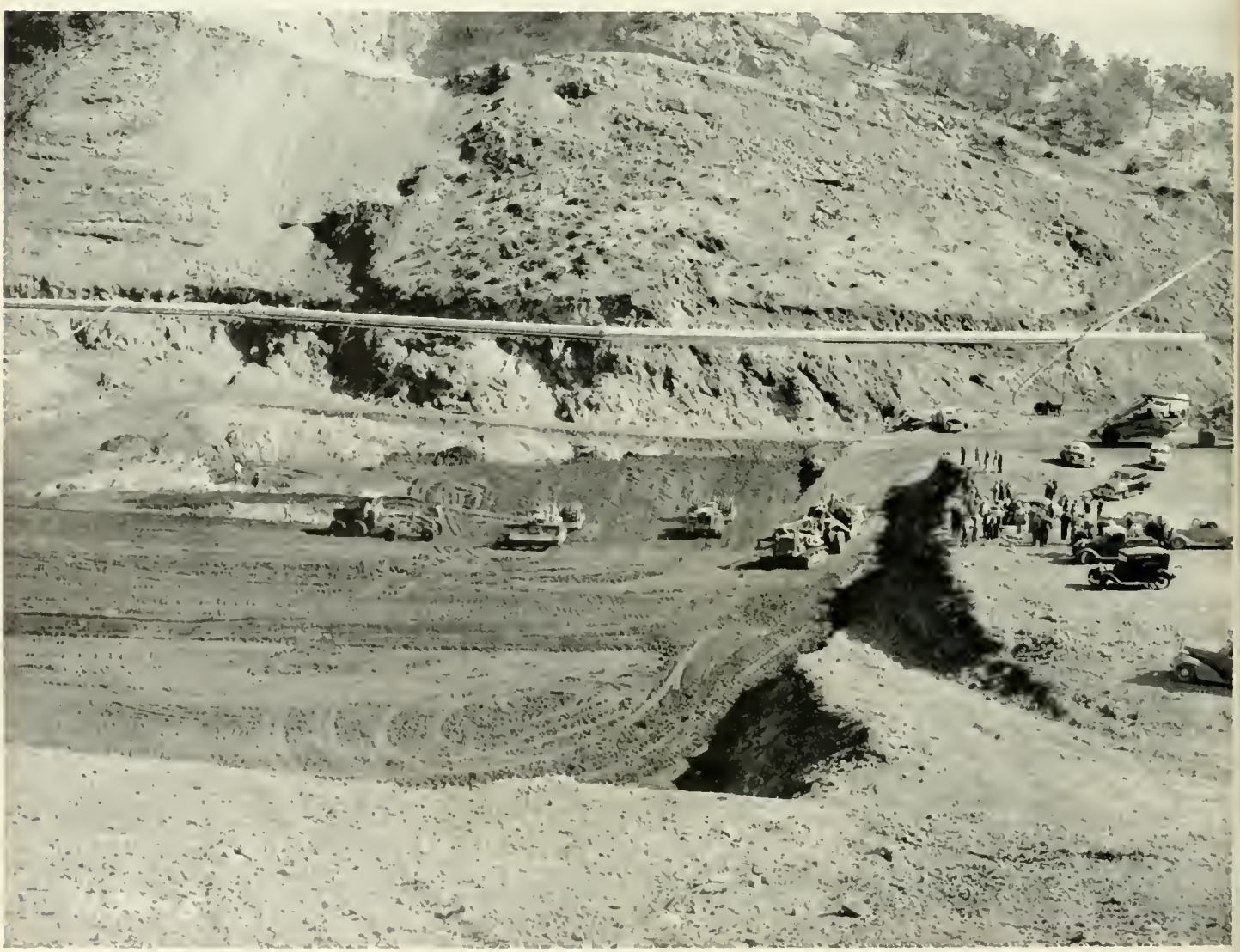
Rector Dam, which will cost $1,350,000, will provide water for four State institutions in the Napa Valley—the Veterans Home at Yountville, Napa State Hospital, the State Farm, and the State Game Farm.

Governor Warren and his official party, including C. H. Purcell, Director of Public Works; A. H. Henderson, Assistant Director; State Engineer Edward Hyatt, A. D. Edmondston, Assistant State Engineer, and James S. Dean, Director of Finance, arrived at Rector Dam at noon and with other notables were guests of honor at a luncheon served in the farm labor camp mess hall near the dam site.

Present and past directors of the Veterans' Home, regional officers of the Veterans Federal Administration and officers of major veterans organizations were among some 250 invited guests who heard Governor Warren pay high tribute to Col. Nelson I. Holderman, for the past 20 years Commandant at Yountville.

In a brief luncheon address, the Governor declared that Rector Canyon Dam will make it possible to develop the Veterans' Home into "the most beautiful and finest in the United States" with an eventual capacity of three times the 1,200 veterans it can now accommodate and will likewise

Heavy construction equipment is excavating tons of material on site of Rector Canyon Dam, Napa County





Participating in celebration at Rector Canyon Dam were, left to right, Col. Nelson I. Holderman, Commandant at Yountville Veterans' Home; Owen Duffy, Superintendent of Napa State Farm; Governor Earl Warren; James S. Dean, Director of Finance, and C. H. Purcell, Director of Public Works

serve the Napa State Hospital with sufficient water for its expansion from 3,000 to 7,000 capacity.

"There is one man," the Governor said, "who is entitled to the lion's share of credit for everything that has been done to improve and expand the veterans home in the past 20 years. That man is our beloved Commandant, Col. Holderman. He has had the courage and perseverance to stay with the job against heavy discouragements until, at last, he can see the light of day and success for his efforts. A man of less courage would have become disheartened and given up long ago."

Taking part in the ceremonies were the directors of the Veterans' Home, Percy King of Napa, George A. Marshall of Vallejo, Reed Robinson and Jean Berent of San Francisco, Matthew Beaton of Monterey, Robert Mitchell of Los Angeles, and Joseph S. Long of Riverside, whose administrative control of the institution passed on May 21st to the new California Veterans' Board.

At the luncheon Thomas Maxwell, Chairman of the Napa County Board of Supervisors, introduced his fellow members of the Board, Ralph Minnahen, Lowell Edington, Charles Tamagni, and N. D. Clark.

Others who spoke briefly were Assemblyman Ernest C. Crowley of Fairfield and State Senator Frank L. Gordon of Suisun, who represent Napa in the State Legislature and who led the fight there for the Rector Canyon project; George G. Radcliffe of Sacramento, one-time Chairman of the State Board of Control; Lawrence C. Stevens of Long Beach, newly appointed Director of the California State Veterans Board; State Director of Finance Dean, State Director of Public Works Purcell, State Engineer Edward Hyatt, and Robert Mitchell, Chairman of the Buildings and Grounds Committee of the Veterans' Home Board of Directors. President Marshall of the Veterans' Home Board of Directors acted as master of ceremonies.

Finance Director Dean credited Governor Warren with main responsibility for "the greatest program of public works in the history of the State." Public Works Director Purcell said time would demonstrate that both the Conn Valley and Rector Canyon Dams will be needed in the Napa area.

Dr. Theo K. Miller, Superintendent of Napa State Hospital; Owen Duffy, Superintendent of the State Farm, and C. K. Van Ornum, Superintendent of the State Game Farm, were seated at the Governor's table. They were members of the committee which arranged the celebration.

After the dinner and speeches, Governor Warren led a motor procession to Rector Canyon for an inspection of the dam site and the excavation work in progress there.

Governor Warren spent seven hours in Napa County, visiting the State Farm and State Game Farm and remaining for a farewell supper at the Veterans' Home for members of the home board of directors.

TREE MAINTENANCE

(Continued from page 13)

is advisable so that the last few cutting strokes can be made with the hand and forearm out of the way of spikes on the falling leaves. The long handle places the cutting hand in a position of greater continued strain than is had from a grip handle and Marvel has fashioned handles with finger grooves so that a better purchase is secured than the former smooth handle provided. The length of the handle remains the same to secure the desirable safety in distance factor.

The large scale tree reconditioning and replanting programs planned for the near future, made necessary by the reduced program of operations since 1941, will doubtlessly afford other opportunities for improvements of working conditions and for increased production at lower costs. It is through such developments in methods of operation and improvements of equipment that working conditions can be made safer and maintenance costs reduced.

NOISIEST DRIVERS

The noisiest drivers in the world are not to be found in Sunday traffic tangles in America, but in China—particularly on the mountainous stretches of such highways as the Ledo Road.

Chinese truck drivers just can't be kept from tooting electric horns far too long for the good of the generating batteries. So, at the request of the Chinese Government, manufacturers are installing hand-operated horns on trucks to be shipped to China.

INCREASING COAST HIGHWAY CAPACITY

By EARL E. SORENSON, District Construction Engineer

THE unprecedented increase in population of the San Diego metropolitan area, due to defense activities as well as natural growth, and also the establishment of Camp Joseph H. Pendleton, the largest Marine base in the country, has severely taxed what is popularly known as "El Camino Real," State Route 2 (U.S. 101), the main coast highway, particularly from Oceanside north.

This section of highway, which was reconstructed or realigned throughout its entire length prior to 1937, has been carrying an increasing amount of traffic until the steadily mounting congestion and resultant accident rate, make the reconstruction of those portions not already four-lanes in width, an immediate necessity.

The sections under present contract extend from the San Luis Rey Bridge at Oceanside, to Aliso Creek, with a short exception over the Santa Margarita River; and from the old Las Flores Underpass to the San Diego-Orange County Line, with a short exception over the Santa Fe tracks at San Onofre.

The above exceptions, and the portion between Aliso Creek and the old Las Flores Underpass, have already been constructed to a four-lane width.

CONTRACTS AWARDED

The work was advertised in four separate units:

N. M. Ball Sons of Los Angeles were awarded the contract for the portion from one mile north of Las Flores to San Clemente. The final total cost of this work will be approximately $685,-124.58.

Fred D. Kyle Company of Pasadena was awarded the contract for construction of the Oceanside Grade Separation structure. The final cost will approximate $100,000.

Basich Brothers Construction Company of Alhambra was awarded the contract for that portion of the highway from the San Luis Rey Bridge to Aliso Creek. The cost of this section will approximate $616,643.58.

A contract for the construction of a new bridge across San Mateo Creek was awarded to Oberg Brothers of Inglewood, at an estimated expenditure of $161,533.70.

The total cost of the improvement, over the entire section, will be approximately $1,563,321.86.

TYPE OF CONSTRUCTION

Traffic is being handled through the work and over an old paved State highway on the east side of the Santa Fe tracks between the old Las Flores Underpass and the San Onofre Grade Separation.

The Portland cement concrete pavement is of uniform eight-inch depth, using no expansion joints, and with crack controlling weakened plane joints at 15-foot intervals. The slabs are tied longitudinally by bolts with threaded sleeve connections.

The material for the Portland cement concrete and the asphaltic concrete for the Basich Brothers contract is being supplied by the Lawrence Canyon Rock Company at Oceanside.

N. M. Ball Sons have erected their own plant in San Mateo Creek for crushing and screening rock.

Aggregate for the bridge contracts is being supplied from the same sources.

The most modern excavation and paving equipment is being used with favorable results and progress.

INTERESTING INNOVATIONS

Several very interesting innovations and experiments are being carried forward on this job.

A machine, constructed by Hurst Lewis of Los Angeles, having rotary disc cutters faced with diamond chips, was used to cut weakened plane joints at the regular 15-foot intervals, over a 1,500-foot length of Portland cement concrete pavement on the N. M. Ball Sons contract. Joints on 500-foot lengths were cut at 24-, 48-, and 72-hour intervals after pouring.

A careful check is being made to determine the relation between the time of cutting and control of the cracking. Results will be observed and data kept for several months, after which it will be evaluated and made available for future reference.

The cutting machine is an ingenious device, mounted on a two-axle, six-tired chassis which travels and steers longitudinally with the pavement. The cutting beam is mounted transversely and controlled hydraulically. The beam carries six disc cutters, and cuts a joint 12-feet in length and 1½ inches deep and approximately $\frac{3}{16}$-inch wide, in an average time of two minutes. The high speed at which the disc cutters revolve necessitate their cooling by a stream of water flowing over them. The entire device is handled by one operator, who controls the mechanism from a platform mounted above the transverse beam, to give him good visibility. Motive power is supplied by a four-cylinder gasoline motor. A small hand machine was also tried out, with satisfactory results.

NEW TECHNICS

A cement stabilized base course will support the Portland cement concrete pavement on the Basich Brothers contract. The material for this course will be mixed through a Barber-Greene mixer, set up at the imported borrow pit as a central mixing plant, and will be laid by conventional and familiar methods developed on previous jobs.

The cement treated base on the N. M. Ball Sons contract was constructed by blending Portland cement with material already in place on the roadbed, and involved new technics. The material to be treated was pulverized, windrowed, and sized, after which the required cement content was dumped by a special cement distributor equipped with a metering device. It was then thoroughly mixed dry, with a conventional Gardner mixer. Water was then metered and injected through the same mixer. The mixed material was spread by a special spreader constructed on the job, rolled with a three-wheel roller, cut to accurate cross section with a Lewis subgrade cutter and finished with a rubber tired roller. It was cured by the application of an impervious membrane of emulsified asphalt.

AN EXPERIMENT

The placing of stabilized base by this method being new, and untried, it was of considerable interest to all concerned, and the Sacramento laboratory assigned a representative to the job to assist and to obtain data for future reference.



Start of grading operations between San Luis Rey bridge and Aliso Creek on U. S. 101

It was generally conceded that the last cutting operation on the stabilized base, to "true" up the grade to receive concrete pavement, should be eliminated, as it resulted in detrimental disturbances of the compacted surface.

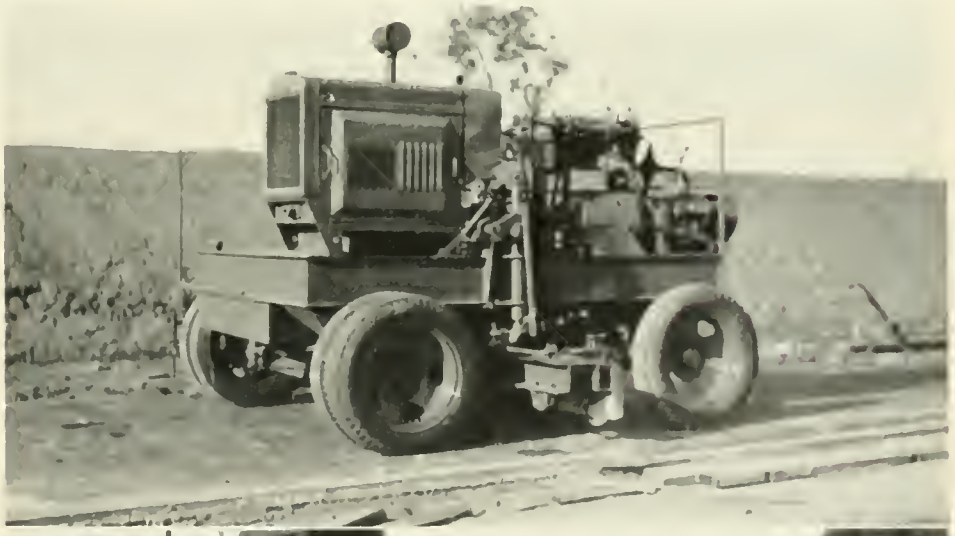
It is probable that new standards of accuracy and tolerance will be set up that will permit sufficient variation to allow the construction of future subgrades without cutting, as it was found that by careful distribution of the material, and careful rolling, the variations obtained were only slightly in excess of those permissible under the controlling specifications.

Results also indicated that some modifications might be made in curing material that would result in deeper penetration of the curing film.

HEADQUARTERS RESEARCH PROJECT

The Headquarters Office Laboratory is carrying on an interesting research project in connection with the use of an air-entraining agent to control the volumetric change in the concrete pavement. It is hoped that data leading to some modification in control joints for cracking can be developed from this study.

For comparison, a section of standard concrete was poured, with no





Upper—Ingenious machine used to cut weakened plane joints at 15-foot intervals on Portland cement concrete pavement

Lower—Concrete joint cutter operated by hand



Construction scene at site of new bridge for southbound traffic across San Mateo Creek

joints, and immediately adjoining another section with no joints but containing Vinsol-Resin, as an air-entraining agent. Comparative data will be kept on these sections for some time, and it is hoped that valuable information can be made available, covering the results.

Jim Beatty, Associate Testing Engineer, is representing the laboratory on this phase of the work.

Barring any unforeseen difficulties in the labor and materials situation, the entire section from Oceanside to San Clemente should be completed and fully opened to traffic by early fall.

The State is represented on the various contracts by the following Resident Engineers: H. F. Caton, Contract 11VC5, SD, Ora-2-D, SCle; R. C. Payne, Contract 11VC7-F, SD-2-Oen, C; W. H. Johnson, Contract 14VC6, SD-2-D; W. V. Cryderman, Contract 14GVC1-F, SD-2-C.

Realignment for southbound traffic across San Mateo Creek Valley



SEAL COATING ON GUAM

By N. R. BANGERT, Assistant Maintenance Engineer

TO A Californian, March would seem to be a poor month for seal coat work, yet, at Guam in the Marianas Islands, some 13½ degrees north of the equator, March is a very favorable month for this phase of road maintenance.

During the latter part of March of this year I had the opportunity to assist the Navy in getting under way on Guam a program of sealing which was eventually to embrace the entire hard surfaced road system of the island, some 86 miles of equivalent 22-foot road.

The fame of California's Division of Highways apparently had been spread to the far corners of the Pacific by employees of the division attached to Seabee units during the war, as the Navy looked to California for advice when faced with the problem of providing protection for the very excellent system of paved roads on the island. Most of these roads have been constructed since the island was reoccupied in August of 1944.

NAVY REQUESTS HELP

The Navy's request for the services of a man to assist resident personnel on the island in outlining the work and establishing proper rates of application of asphalt and rock, came through State Highway Engineer George T. McCoy early in March. It was my pleasure to be offered the opportunity to represent the division in this capacity.

As every effort was being made by the Navy to complete the seal coat project before the last of the Seabee units were deactivated and before the rainy season began, the trip to Guam was made by plane. The round trip required about 63¼ hours of flying time and embraced a distance of about 11,250 nautical miles. Travel was entirely by four-motored C-54 planes of the Naval Air Transport Service, stops being made at Honolulu, Johnston Island, and Kwajalein.

Rain fell nearly every day during my stay on Guam, yet March is considered one of the dry months of the year. The temperature was comfortably warm, with a low of about 73 degrees and a high of 84 degrees. The annual rainfall for the island is reported at about 100 inches. Cloudy skies were the rule and it was not uncommon to stop sealing operations several times during the day to allow the pavement to dry following a hard but brief tropical shower.

CORAL USED ON BASE

Large deposits of coral located in the central part of the 200-square-mile island supplied the first engineer outfits that accompanied the assault troops ashore in 1944 with an excellent road material with which to construct many miles of modern highway in record time.

The coral used for base afforded a substantial foundation for the 2½ inches of asphalt concrete surfacing with which the major portion of the graded roads were paved. This asphalt concrete, used for both road and airfield construction, was produced from crushed quarried coral and 60-70 penetration asphalt cement. Five hot plants are said to have been in operation on the island while the construction program was at its height.

The 11 miles of Marine Drive, Route 1, which extends between the site of the former city of Agana and the warehouse and dock area at Apra Harbor is paved to a width of 44 feet. The pavement is bordered by 6-foot untreated coral shoulders. The so-called secondary roads which branch from Marine Drive to other important island installations are similarly bordered and carry pavements 22 feet or 33 feet in width.

ASPHALT SHIPPED IN DRUMS

All asphalt used on the island is shipped in metal drums. The emptying of these drums, especially the ones containing the 60-70 penetration asphalt used for the asphalt concrete pavement construction and for sealing, presented a problem but one which had been ingeniously solved by the hot plant gangs during the early stages of construction.

Briefly, drums were brought in from the stockpile area on chain slings suspended from tractor mounted booms, tops were punctured to admit air and the bottoms of the drums all but cut off by means of an air chisel. The drums were then hoisted up an incline, hung bottom down over the primary heating pit, and the top, sides and bottom heated by a large kerosene torch until the core of hard asphalt dropped from the metal container.

A quantity of mixing type emulsified asphalt was also in stock on the island and this material was used to a limited extent for surface sealing.

LOTS OF EQUIPMENT, BUT—

The construction battalions were well supplied with the latest in oil and chip spreading equipment. Screenings of ½-inch by ¼-inch size were produced by crushing a quarried coral. Hauling was done by a fleet of six wheel, 5 cubic yard trucks. Oil distributors of a well known eastern make were mounted on four-wheel trailers, but these were found to be somewhat cumbersome to turn or to line up after a false start.

Although the island was literally weighted down by all types of heavy construction equipment, two items of equipment generally considered essential on seal coat jobs were lacking or at least, up until the time I left, had not been high-jacked from Army or Marine outfits. These were side sweeping power brooms and oil retorts.

Pavements were cleaned, for the most part, by compressed air supplemented by a push broom brigade of Jap prisoners. The asphalt, although initially heated by steam, was raised to the spreading temperature by means of the flue type heaters with which each distributor was equipped.

Tandem rollers of popular eastern make were available for rolling. However, this phase of the sealing operation was held to a minimum due to the soft aggregate used.

PUBLIC WORKS BATTALION

The seal coating was carried on by the 109th Naval Construction Battalion with whom I was quartered while on the island. This outfit, a so-called Public Works Battalion, in addition to doing the seal coat work, also manned the only hot plant then in operation, and took care of the telephone, electric, and water supply systems on the island. Members of the 103d Naval Construction Battalion carried on a portion of the road maintenance and operated the quarry and

(Continued on page 32)

Highway Bids and Contract Awards for April and May 1946

April 1946

CONTRA COSTA COUNTY — Portions between Pittsburg and 4 miles east of Brentwood, about 10.1 miles, shoulders to be widened with imported borrow and surfaced with plant-mixed surfacing and penetration treatment and a bridge to be widened. District IV, Route 75, Sections C, D. Contract awarded to Lee J. Immel, San Pablo, $76,297.10.

HUMBOLDT COUNTY—Between Loleta and Fields Landing, about 4.0 miles, base to be reinforced and surfaced with plant-mixed surfacing. District I, Route 1, Section G. Contract awarded to Mercer Fraser Co., Eureka, $89,643.

KERN COUNTY—Between Lost Hills and Wasco, about 4.7 miles, shoulders to be widened with imported borrow and untreated rock surfacing. District VI, Route 33, Section C. Williams Construction Co., Los Angeles, $22,983; Brown, Doko & Baun, Pismo Beach, $24,970; W. C. Railing, Redwood City, $26,216; Volpa Brothers, Fresno, $28,135; Griffith Company, Los Angeles, $28,439; Jesse S. Smith, Glendale, $28,675; Normal I. Fadel, North Hollywood, $28,832; George E. France, Visalia, $30,292. Contract awarded to Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, $22,351.

KERN COUNTY—At Bakersfield, between Brundage Lane and 24th Street, about 1.9 miles, to be graded and paved with Portland cement concrete and asphalt concrete. District VI, Route 4, Section C, Bkd., J. E. Haddock, Ltd., Pasadena, $474,378.55. Contract awarded to Griffith Co., Los Angeles, $416,169.70.

LASSEN COUNTY — Between Viewland and Secret Valley, about 13.8 miles to be surfaced with imported gravel base and plant-mixed surfacing. District II, Route 73, Section B. W. C. Railing, Redwood City, $121,035; Isbell Construction Co., Reno, $121,679; A. Teichert & Son, Inc., Sacramento, $121,761; Fairey-Hammond Inc., San Francisco, $121,900; The Utah Construction Co., San Francisco, $122,422; M. J. Ruddy & Son, Modesto, $124,791. Contract awarded to E. B. Bishop, Orland, $118,861.

LOS ANGELES COUNTY—In the cities of Los Angeles and Long Beach, on Terminal Island Freeway between Henry Ford Avenue and Willow Street, about 2.1 miles to be graded and paved with asphalt concrete. District VII. James I. Barnes Construction Co., Santa Monica, $1,218,496; Griffith Co., Los Angeles, $1,241,804; Warren Southwest Inc. and C. G. Willis & Sons, Inc., Los Angeles, $1,278,986; Peter Kiewit Sons Co., Los Angeles, $1,392,829; J. E. Haddock, Ltd., Pasadena, $1,412,079; Guy F. Atkinson Co., Long Beach, $1,436,000; Basich Bros. Construction Co. and Basich Bros., Alhambra, $1,493,476; Clyde W. Wood, Inc., North Hollywood, $1,592,457. Contract awarded to Macco Construction Co., Clearwater, $1,141,080.

LOS ANGELES COUNTY — Over the tracks of the Union Pacific, Southern Pacific and Pacific Electric at Anaheim Street in the City of Los Angeles, a structural steel overhead crossing to be constructed. District VII, Terminal Island Freeway. Peter Kiewit Sons Co., Los Angeles, $892,606; E. B. Bishop, Orland, $897,226; Macco Construction Co., Clearwater, $897,732; Guy F. Atkinson Co., Long Beach, $905,030; Baruch Corp., Los Angeles, $971,675; Robert E. McKee, Los Angeles, $972,336; Griffith Co., Los Angeles, $1,014,069. Contract awarded to E. W. Elliott Construction Co., San Francisco, $849,357.

LOS ANGELES COUNTY—On Terminal Island Freeway over the tracks of the Union Pacific Railroad in the City of Los Angeles, a structural steel overhead crossing to be constructed. District VII. E. B. Bishop, Orland, $599,879; E. W. Elliott Construction Co., San Francisco, $621,886; Guy F. Atkinson Co., Long Beach, $622,734; Oberg Bros., Inglewood, $625,379; Peter Kiewit Sons Co., Los Angeles, $633,629; Robert E. McKee, Los Angeles, $651,366; Pacific Bridge Co., San Francisco, $658,915; George Pollock Co., Sacramento, $663,504; Carlo Bongiovanni, Los Angeles, $699,389; Griffith Co., Los Angeles, $733,712. Contract awarded to Macco Construction Co., Clearwater, $599,121.

LOS ANGELES COUNTY—In the Cities of Los Angeles and Long Beach on Pacific Coast Highway between Dominguez Channel and San Gabriel Avenue, about 0.7 mile to be graded and paved with asphalt concrete and four bridges to be constructed. District VII, Route 60. Griffith Co., Los Angeles, $1,710,474; Macco Construction Co., Clearwater, $1,756,854; Guy F. Atkinson Co., Long Beach, $1,793,247; Peter Kiewit Sons Co., Los Angeles, $1,862,841; Warren Southwest Inc. and C. G. Willis & Sons, Los Angeles, $1,999,056. Contract awarded to James I. Barnes Construction Co., Santa Monica, $1,672,266.

LOS ANGELES COUNTY—On Anaheim Street Approach Road from Terminal Island Freeway at Nicholson Avenue in the City of Los Angeles, a structural steel overhead crossing with graded approaches surfaced with asphalt concrete to be constructed. District VII. Macco Construction Co., Clearwater, $267,333; Griffith Co., Los Angeles, $269,224; Guy F. Atkinson Co., Long Beach, $282,563; James I. Barnes Construction Co., Santa Monica, $297,999; Norman I. Fadel, North Hollywood, $331,217; The Contracting Engineers Co., Los Angeles, $333,362. Contract awarded to Oberg Bros., Inglewood, $264,279.

LOS ANGELES COUNTY—On Ramona Freeway between Macy Street and Indiana Street, a distance of about 1.9 miles, chain link fence to be furnished and installed. District VII, Route 26. Contract awarded to Alcorn Fence Co., Los Angeles, $28,573.

MENDOCINO COUNTY — At Dooley Creek one mile east of Hopland, a reinforced concrete slab bridge on concrete pile bents to be constructed and about 0.12 mile of approaches to be graded and surfaced with road-mix surfacing and seal coat applied thereto. District I, Route 16, Section A. Erickson, Phillips & Weisberg, Oakland, $43,055; Mercer Fraser Co., Eureka, $40,420; Kiss Crane Company, San Pablo, $47,128. Contract awarded to F. Fredenberg, Temple City, $40,069.

MERCED COUNTY—Between Black Rascal Creek and Buhack Station, about 3.8 miles to be graded and paved with Portland cement concrete and four bridges to be constructed. District X, Route 4, Section C. Marshall S. Hanrahan, Redwood City, $458,135; N. M. Ball Sons and Lew Jones Construction Co., Berkeley, $477,077; Fredrickson & Watson Construction Co., Oakland, $485,368; Guy F. Atkinson Company, South San Francisco, $498,397; A. Teichert & Son, Inc., Sacramento, $504,864. Contract awarded to Gunner Corporation, Pasadena, $415,297.

ORANGE COUNTY—Between Los Patos Avenue and Sunset Beach and Second Street in Seal Beach, about 2.3 miles to be resurfaced with plant-mixed surfacing and shoulders to be widened with imported borrow and bituminous surface treatment applied. District VII, Route 60, Sections A, B1.B. Sully Miler Contracting Co., Long Beach, $52,961; Owl Truck & Construction Co., Compton, $54,897; J. E. Haddock, Ltd., Pasadena, $55,091; Oswald Bros., Los Angeles, $55,447; Jesse S. Smith, Glendale, $56,200; John J. Swigart Co., Torrance, $56,943. Contract awarded to Griffith Co., Los Angeles, $52,030.

RIVERSIDE COUNTY—Between 6 miles east of Desert Center and Hopkins Well, about 10.4 miles to be surfaced with road-mixed surfacing and a seal coat to be applied. District XI, Route 64, Sections C, D. Phoenix Construction Co. and Oilfields Trucking Co., Bakersfield, $55,804; R. R. Hensler, Glendale, $56,815; Basich Bros. Construction Co. and Basich Bros., Alhambra, $68,950; Vinnell Co., Alhambra, $71,254; Herz Paving Co., San Bernardino, $78,176; Clyde W. Wood, Inc., North Hollywood, $78,540; S. Edmondson & Sons, Los Angeles, $81,467; J. E. Haddock, Ltd., Pasadena, $83,652; Spencer Webb, Los Angeles, $84,525; Owl Truck & Construction Co., Compton, $85,950; Norman I. Fadel, North Hollywood, $95,385. Contract awarded to Arthur A. Johnson, Laguna Beach, $50,932.

SAN BERNARDINO COUNTY—Between Vineyard Avenue and Etiwanda Avenue, about 5.7 miles to be graded and paved with Portland cement concrete and reinforced concrete bridges to be constructed. District VIII, Route 26, Section D. Griffith Co., Los Angeles, $491,169; N. M. Ball Sons, Los Angeles, $520,561; Basich Bros. Construction Co. and Basich Bros., Alhambra, $530,894; J. E. Haddock, Ltd., Pasadena, $534,342; E. L. Yeager, Riverside, $588,716; Peter Kiewit Sons' Co., Arcadia, $612,371. Contract awarded to Matich Bros., Colton, $478,203.

YOLO COUNTY—At State Highway nursery about three miles east of Davis, drilling and casing a water well. District III, Route 6, Section A. Contract awarded to R. L. Norris, Sacramento, $1,960.

SISKIYOU COUNTY — At Dunsmuir, about 0.15 mile in length, an 18-inch reinforced concrete pipe storm drain to be installed and existing cross-drains connected thereto. District II, Route 3, Section A. O'Connor Bros., Red Bluff, $8,996; Luigi Cosentino, Dunsmuir, $11,273. Contract awarded to M. W. Brown, Redding, $8,237.

SISKIYOU COUNTY—Between Cougar and Dorris, about 31.7 miles, seal coat to be applied. District II, Route 72, Sections B, C. Folsom & Drollinger, Sacramento, $37,880; Clements & Co., Hayward, $40,955; Harms Bros., Sacramento, $41,015; J. Henry Harris, Berkeley, $44,705. Contract awarded to Morgan Construction Co., Pleasanton, $36,937.

SISKIYOU COUNTY — Between Shasta River and Gazelle, about 7.8 miles to be surfaced with plant-mixed surfacing. District II, Route 3, Section B. Contract awarded to Clements & Co., Hayward, $23,927.

SISKIYOU COUNTY—Portions between Weed and Yreka, about 20.4 miles to be surfaced with imported borrow base and plant-mixed surfacing. District II, Route 3, Section B. E. B. Bishop, Orland, $174,004; Fredrickson Bros., Emeryville, $189,463; W. C. Railing, Redwood City, $201,107; J. P. Brennan, Redding, $249,676. Contract awarded to Clements & Co. and Milo A. Browne, Hayward, $166,885.

SHASTA COUNTY — Between 4.5 miles east of Ingot and Montgomery Creek, about 9.7 miles to be surfaced with plant-mixed surfacing. District II, Route 28, Section B. E. A. Forde, San Anselmo, $55,910; E. B. Bishop, Orland, $56,692; J. P. Brennan, Redding, $57,065; Oilfields Trucking Company and Phoenix Construction Company, Bakersfield, $58,392; C. M. Syar, Vallejo, $71,339. Contract awarded to W. C. Railing, Redwood City, $55,481.

SANTA CLARA COUNTY—On Bayshore Freeway at Santa Clara Street in the City of San Jose, a separation structure to be constructed and approaches about 0.6 mile in length to be graded and surfaced with Port-

nd cement concrete and asphalt concrete on rusher run base. District IV, Routes 68, 2, ection S.Js. Macco Construction Co., Clearater, $391,395; N. M. Ball Sons & Lew ones Construction Co., Berkeley, $395,457; an Caputo & Edward Keeble, San Jose, 00,710; Earl W. Heple, San Jose, $115,600. ontract awarded to Fredrickson & Watson onstruction Co., Oakland, $379,441.

SAN DIEGO COUNTY—About 17 miles ast of Oceanside across San Luis Rey River nd Keys Canyon Creek, two steel girder idges to be constructed. District XI, Route 7, Section G. C. B. Tuttle & Schmidt Bros. ontractors, Long Beach, $180,461; Macco onstruction Co., Clearwater, $180,480; Fred . Kyle, Pasadena, $181,144; Haddock Engiers, Ltd., Oceanside, $209,629; M. H. olden Construction Co., San Diego, $203,-03. Contract awarded to Spencer Webb, Los ngeles, $167,316.

SAN DIEGO COUNTY—Across Samagaa Creek and Descanso Creek near Desnso, two bridges and approaches to be conructed. District XI, Route 78, Section A. . H. Golden Construction, San Diego, $92,-34; Carrol & Foster, San Diego, $102,643. ontract awarded to Oberg & Cook, Los Anles, $87,433.

SAN DIEGO COUNTY—Between 2 and 7 miles north of Moretti's, reinforced conete slab bridges to be constructed across Ilatagual Valley Creek, Canada Verde Creek, nd Acorn Creek. District XI, Route 78, ections D, E. Oberg & Cook, Los Angeles, 45,053; Macco Construction Co., Clearwater, 48,745; F. Fredenburg, Temple City, $49,-26; C. B. Tuttle, Long Beach, $49,878; horsten & Dahl, Santa Monica, $60,206; Valter H. Barber, La Mesa, $61,028; Hadock Engineers, Ltd., Oceanside, $73,850. ontract awarded to O'Rourke & Parker, arvey, $39,344.

SAN DIEGO COUNTY — Between 0.4 ile south of Mission Valley Road and 0.5 ile north of the north city limits of San iego, about 4.1 miles to be graded and surced with Portland cement concrete pavent. District XI, Route 77, Section SD, A. . M. Ball Sons, Los Angeles, $1,118,768; riffith Co., Los Angeles, $1,142,807; Peter ewit Sons Co., Arcadia, $1,194,389; Bressi Bevanda Constructors, Inc. & R. E. Hazard Sons Contracting Co., Los Angeles, $1,260,-32; Daley Corp, San Diego, $1,270,722; E. Haddock, Ltd., Pasadena, $1,376,564; . R. Dennis Construction Co., San Diego, ,589,111. Contract awarded to Basich Bros. onstruction Co. and Basich Bros., Alhamra, $1,008,840.

CONTRA COSTA COUNTY — Portions etween Pittsburg and 4 miles east of Brentood, about 10.1 miles, shoulders to be wided with imported borrow and surfaced with ant mixed surfacing and penetration treatent and a bridge to be widened. District V, Route 75, Sections C,D. Contract warded to Lee J. Immel, San Pablo, $76,-07.10.

HUMBOLDT COUNTY—Between Loleta nd Fields Landing, about 4.0 miles in length, ase to be reinforced and surfaced with plantixed surfacing. District I, Route 1, Section G. Contract awarded to Mercer Fraser o., Eureka, $89,643.

KERN COUNTY—Between Lost Hills nd Wasco about 4.7 miles, shoulders to be idened with imported borrow and untreated ck surfacing. District VI, Route 33, Section C. Williams Construction Co., Los Anles, $22,983; Brown, Doko & Baun, Pismo each, $24,970; W. C. Railing, Redwood ity, $26,216; Volpa Brothers, Fresno, $28,-35; Griffith Company, Los Angeles, $28,439; esse S. Smith, Glendale, $28,675; Norman I. adel, North Hollywood, $28,832; George E. rance, Visalia, $30,292. Contract awarded Oilfields Trucking Co. & Phoenix Construcon Co., Bakersfield, $22,351.

KERN COUNTY—At Bakersfield, between rundage Lane and 24th Street, about 1.9 iles to be graded and paved with Portland cement concrete and asphalt concrete. District VI, Route 4, Section C, Bkd. J. E. Haddock, Ltd., Pasadena, $174,378.55. Contract awarded to Griffith Co., Los Angeles, $116,169.70.

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BUTTE COUNTY — Between Oroville Wye and Nelson, between Durham railroad crossing and Chico and between Big Chico Creek and Sixth Street in Chico, about 11.8 miles in net length, existing surfacing to be repaired with plant mixed surfacing and crusher run base and borders and shoulders to be constructed of crusher run base and imported borrow. District III, Route 3, B, C. Chc. J. E. Johnston, Stockton, $117,700. Contract awarded to Lester L. Rice, Marysville, $101,971.25.

DEL NORTE COUNTY — Between 6.3 miles and 2.6 miles south of Crescent City, about 3.7 miles, imported base material to be placed and a seal coat applied thereto. District I, Route 1, Section B. Fairey-Hammond, Inc., San Francisco, $101,006; Mercer-Fraser Company, Eureka, $102,423. Contract awarded to W. C. Railing, Redwood City, $100,845.30.

HUMBOLDT COUNTY — Between Patrick's Point and Big Lagoon, about 3.4 miles to be surfaced with plant mixed surfacing on imported base material and a seal coat to be applied to the plant-mixed surfacing. District I, Route 1, Section J. W. C. Railing, Redwood City, $95,185; Fairey-Hammond, Inc., San Francisco, $112,811; Westbrook & Pope, Sacramento, $102,620. Contract awarded to Mercer, Fraser Company, Eureka, $92,375.

KERN COUNTY—Between 1.6 miles and 1.25 miles south of Grapevine Station, traffic detlector to be furnished and installed. District VI, Route 4, Section A. George von KleinSmid, Bakersfield, $22,300. Contract awarded to Griffith Co., Los Angeles, $19,980.

LAKE COUNTY—Between one and two miles south of Upper Lake, two bridges to be constructed, one across Robinson Creek and the other across Scott Creek. District I, Route 89, Section E. Erickson Phillips & Weisberg, Oakland, $147,053; R. G. Clifford, South San Francisco, $149,157. Contract awarded to Kiss Crane Co., San Pablo, $129,-345.20.

MENDOCINO COUNTY—Between Willits and 2.6 miles northerly, about 2.6 miles in length to be surfaced with plant-mixed surfacing on imported base material. District I, Route 1, Section F. A. R. McEwen, Sacramento, $72,160; Clements & Co., Hayward, $79,952; Fairey-Hammond, Inc., San Francisco, $83,516. Contract awarded to C. M. Syar, Vallejo, $69,726.

MENDOCINO COUNTY—At Slick Rock Creek about 5.6 miles south of Point Arena, about 1 mile to be graded and imported base material placed. District I, Route 56, Section A. Harms Bros., Sacramento, $128,-844; Peter Sorensen, Redwood City, $136,-291; J. Henry Harris, Berkeley, $140,689; Louis Biasotti & Son, Stockton, $174,095. Contract awarded to Piombo Bros. & Co., San Francisco, $121,695.

PLUMAS COUNTY — Across Hamilton Branch between Big Meadows Dam and Lassen County line, a steel girder bridge with concrete deck to be constructed. District II, Route 523. M. A. Jenkins, Sacramento, $73,880; S. J. Amoroso Construction Co., San Francisco, $93,449; Erickson, Phillips & Weisberg, Oakland, $98,267. Contract awarded to Kiss Crane Company, San Pablo, $72,173.

SAN BERNARDINO COUNTY—Between Highland Avenue and City Creek Bridge, about 3.2 miles, to be graded and surfaced with plant-mixed surfacing, and a bridge to be constructed across City Creek. District VIII, Route 207, Section A. Nathan A. Moore, San Gabriel, Alt. "A," $817,472; Westbrook & Pope and E. B. Bishop, Sacramento, Alt. "B," $913,632; C. G. Willis & Sons, Los Angeles, Alt. "B," $1,049,660; Vinnell Co., Alhambra, Alt. "B," $1,249,655; Peter Kiewit Sons' Co., Arcadia, Alt. "B," $1,326,049. Contract awarded to Denni Investment Corp., Wilmington, Alt. "B," $652,359.

SAN JOAQUIN COUNTY — Between Byron Road and Banta Road, a distance of about 5.5 miles to be repaired with untreated rock base and plant-mixed surfacing. District X, Route 5, Section A, Tra. Geo. French, Jr., Stockton, $114,351; Fredrickson Bros., Emeryville, $114,680; Louis Biasotti & Son, Stockton, $119,704; A. Teichert & Son, Inc., Sacramento, $126,526; M. J. B. Construction Co., Stockton, $165,817. Contract awarded to M. J. Ruddy & Son, Modesto, $113,002.

TRINITY COUNTY — Constructing a bridge about 58 miles west of Red Bluff across Hayfork Creek. District II, Route 29, Section A. O'Connor Bros., Red Bluff, $8,260; Evans Construction Co., Berkeley, $9,833. Contract awarded to C. C. Gildersleeve, Willows, $7,573.62.

YOLO COUNTY—Between one mile east of Davis and Swingle and between 2½ miles north of Arcade Station and junction Route 6, a length of about 7.3 miles to be repaired with plant-mixed surfacing and crusher run base. District III, Routes 6, 99, Sections A,B. J. R. Reeves, Sacramento, $78,171. Contract awarded to A. Teichert & Son, Inc., Sacramento, $71,525.

YOLO COUNTY — Between Cache Creek and Dunnigan, about 14 miles to be repaired with plant-mixed surfacing and crusher run base and imported borrow to be placed on shoulders. District III Route 7, Sections B,C. McGillivray Construction Co., Sacramento, $157,122; A. Teichert & Son, Inc., Sacramento, $160,910; J. R. Reeves, Sacramento, $163,018; Harms Bros., Sacramento, $165,722; Lester L. Rice, Marysville, $197,-862; Fairey-Hammond, Inc. and Louis Biasotti and Son, San Francisco, $198,639. Contract awarded to Fredrickson Bros., Emeryville, $149,536.25.

ALAMEDA AND CONTRA COSTA COUNTIES—Portions between El Cerrito Hill Overhead in Albany and Carquinez Bridge, about 10.5 miles in length, shoulders to be repaired with crusher run base, plant-mixed surfacing and penetration treatment and a decelerating lane to be constructed. District IV, Routes 69,14, Sections Alb, Reh. ECr, A. Pin, Her, B. Lee J. Immel, San Pablo, $82,-291; J. Henry Harris, Berkeley, $84,714; C. M. Syar, Vallejo, $97,631; Independent Construction Co., Ltd., Oakland, $121,882. Contract awarded to J. R. Armstrong Construction Co., El Cerrito, $79,668.80.

CALAVERAS COUNTY — Construct cattle pass about nine miles north of Angels Camp. District X, Route 65, Section B. Patrick M. Sofarelli, Hayward, $8,109; C. C. Gildersleeve, Willows, $7,446. Contract awarded to Bati Rocca, Stockton, $4,827.

KERN COUNTY—Between Famoso and Cecil Avenue in Delano, about 10.4 miles to be repaired with plant-mixed surfacing. District VI, Route 4, Section F,Dln. Gunner Corporation, Pasadena, $102,650. Contract awarded to Griffith Co., Los Angeles, $90,532.

MODOC COUNTY — Between Eagleville and 4 miles north of Lake City, about 29.5 miles, portions to be graded, plant mixed surfacing to be placed on new subgrade and existing surfacing, and seal coat to be applied thereto. District II, Route 513, Sections B,C,D. A. Teichert & Son, Inc., Sacramento, $418,836; Lester L. Rice, Marysville, $426,-374. Contract awarded to E. B. Bishop & D. Gerald Bing, Orland, $409,590.50.

Lawyer—"Now if you want my honest opinion—"

Client—"I don't. I want your professional advice."

NEED FOR MORE DIVIDED HIGHWAYS

The following address was delivered by C. H. Purcell, Director of Public Works, at the Traffic Safety Conference held at the call of Governor Earl Warren in Sacramento on May 1, 1946.

CALIFORNIA today is facing a very serious and alarming problem in motor transport. The congestion of traffic on the main-line highways of the State, both inside and outside the cities, has become so aggravated that there is actually a serious bottleneck to the movement of all those products which are produced in the State, and which must be moved by motor transport over at least a portion of the trip from producer to consumer. The seriousness of this clogging of the arteries of the motor transport system is manifest in the enormous toll that is being taken daily through the economic loss occasioned by traffic accidents.

That traffic congestion and traffic accidents are very closely related and must be given simultaneous consideration is immediately apparent when it is realized that about 60 per cent of the traffic accidents reported on the rural State highways of the State occur on only 1,600 miles of that system—and that these particular sections are all carrying more traffic than can be safely accommodated on two lanes.

I do not want to bore you with statistical data, but there are a few highlights in connection with traffic accidents that are necessary to have in mind in any consideration of remedial measures. I am speaking with regard to rural State highways. About 40 per cent of the accidents occur at intersections. And about 30 per cent are reported as being head-on collisions.

Considering these facts, together with the fact just stated that the majority of accidents occur on crowded two-lane highways, it would appear that the divided multiple-lane highway should provide for safer movement of traffic. Actually, this is true. We have already constructed and have in operation a sufficient mileage of divided highways to know that not only do they relieve the congestion and clogging of traffic that occurs on two-lane roads carrying comparable traffic, but also there are fewer accidents. Intersection structures which separate traffic streams at grade, and intersection control likewise, very materially improve operating conditions.

The traffic accident record for the City of Los Angeles for the year 1945 shows that 70 per cent—seven out of every ten—of the persons killed in traffic accidents were pedestrians. If we will provide means to separate pedestrian from high-speed motor traffic we will reduce the accident toll. Pedestrian accidents do not occur on freeways, simply because pedestrians are not permitted to use freeways.

The perplexing problem of traffic accidents the State is facing and about which something most certainly must be done if California is to go forward as it should in the economic scheme of things, has given me personally much concern for a long time. And I assure you that it is very gratifying to me that this enlightened and serious-minded group of citizens has been called together by Governor Warren to formulate a California program, which I hope can be presented with a united front at the Conference called by the President to meet in Washington later in the month.

It is also a source of considerable satisfaction to me that the Legislature has recognized the pressing importance of the motor transport problem to California through the appointment of an interim legislative committee. This committee, I understand, is making a very thorough and comprehensive analysis of the entire highway, street, and bridge problem of the State.

The Division of Highways has recently prepared and submitted to the Legislature a Critical Deficiency Report on the State highway system. In this report it defined a critical deficiency in such terms as: Critical Bridges—Bridges that are considered critical because they were about ready to fall down. Some of them have already fallen down since the report was made. Other deficiencies were defined as inadequate lane capacity, as inadequate roadway from a structural standpoint, and so on, in such terms as engineers use.

Of this entire Critical Deficiency Program, about 77 per cent in dollar volume was because of inadequate width of roadway to accommodate the present daily traffic. In other words, our greatest and most expensive highway need today is for more room, more paved area on which motor vehicles can operate. And because of this lack of elbow room there are heavy concentrations of traffic accidents.

This congestion is, quite naturally, more pronounced and more aggravated at intersections, where traffic streams converge and cross; hence the greater accident concentration at places of cross movement. The intersection problem is especially pronounced, and there is a pressing and urgent demand and need for installation of traffic signals. A recent estimate compiled by the Division of Highways shows a need for such signal installations in excess of $1,000,000.

These deficiencies on the highway system; this inadequate provision for daily movement, the inadequacy of bridges and intersections, have been gradually accumulating since before the war.

While there has been an increase in total gasoline tax and registration fees during the last 10 or 12 years prior to the war, the road cost for traffic service per vehicle unit has increased so materially that there has been a gradual losing of ground insofar as overall improvement of the entire highway system was concerned. As a result, we are now reaping the harvest in terms of traffic congestion and traffic accidents.

With all that is being done, I feel that we can look forward with reasonable assurance that the beginning of a solution of some of the serious problems with which we are beset is at least in sight.

There is much that can be done and is being done to alleviate the traffic accident toll by the Motor Vehicle Department, and particularly the California Highway Patrol. The education of younger drivers is proving to be of material benefit; and other agencies, such as the automobile clubs, the safety councils, the traffic courts, are all doing good, sound work.

But the real need, the most important work to be done, the one thing above all others that will solve this most urgent problem, is the providing of adequate highways—a place for motor traffic to move.

CALIFORNIA MISSIONS

(Continued from page 19)

hich he had been treated, and of the rivolous diffienlties' put in the way y the missionary of an unprofitable sistencia (He was wrong; San Rafael as a mission at this date) through nderhand efforts,' and the aid of onfederate padres.'

"The Fr. Presidente, he goes on, had bstinately kept silent, though not orse in health than usual and perctly able to confirm the orders of his redecessor. The confederates were ll blind to the circumstances and had xerted themselves in the office of atan by throwing obstacles in the ay of a great enterprise, especially r. Duran (missionary of Mission San ose). The new presidente, too, eemed to be one of the plotters, inasnuch as he had complained that his ermission should have been awaited, hough all might have died before it ame. The angry young friar then oncluded in substance as follows: 'I ish to know whether the diputacion as any authority in this province, and these men can overthrow Your lonor's wise provision. If I can not o it here, where as we all agree is the est spot in California for the purpose, will leave the country.'"

GOVERNOR COMPROMISES

From San Juan Bautista, Fr. Sarria rote a long letter of protest to the Governor. The latter replied to the ffect that inasmuch as the Franciscans ad during 50 years made no progress n the conversion of the northern ndians, the secular authority proosed to take charge. The Governor ompromised with Presidente Sarria y abandoning efforts to move Mission Dolores and Mission San Rafael to Sonoma and Fr. Sarria permitted Fr. Altimira to take up his quarters at Sonoma.

In 1924 the mission had a granary, riest's house and seven habitations or guards. At the close of that year he station had 693 neophytes, all but 6 of whom had come from Missions Dolores, San Rafael and San Jose. When General Mariano Vallejo was nade comisionado in 1834, Mission Solano was secularized and its movable roperty distributed among the ndians, most of whom returned to heir rancherias. During the 11 years f its existence the records of the mission showed 1,315 baptisms, 278 marriages and 651 deaths. The station never was a prosperous one.

General Vallejo was ordered in 1834 to lay out a pueblo around the mission. Thus began the present-day town of Sonoma. The old mission chapel became the parish church and was used until 1880, when a new church was erected with funds derived from the sale of the old mission and grounds by Bishop Alemany to a German named Schocken. The latter used the mission for storing hay and wine. In 1903 the property was acquired by W. R. Hearst for $5,000.

MISSION NOW STATE MUSEUM

On the northeast corner of the Plaza laid out by Vallejo is the Bear Flag Monument, marking the spot where the Bear Flag of California Republic was raised on June 14, 1846. Nearby is the mission and just north of the monument are the old Mexican barracks erected in 1836 to quarter Mexican troops. One block east is the Ray House of wood and adobe built in 1846 and which was U. S. Army headquarters in the late forties.

The Sonoma Valley Woman's Club interested itself in the old mission in 1910, obtained a lease on the property and raised funds to make necessary repairs. The club had the cooperation of the Native Sons and Daughters of Sonoma and other towns and cities. A public fund was raised, the property was purchased and then presented to the State of California. The Legislature made an appropriation for restoration and on June 14, 1914, Mission San Francisco Solano was opened to the public as a museum and State landmark. Situated in the heart of the Valley of the Moon, it is well worth a visit.

And so, with Mission San Francisco Solano ends this series of stories of the California Missions which ever will stand as monuments to Fr. Junipero Serra and his faithful colleagues.

Visitors to Mission San Francisco Solano from the south will follow U. S. 101 from Sausalito to Petaluma and turn east on State Route 104 to Sonoma. Coming from the north, leave U. S. 101 at Santa Rosa and follow State Route 51 direct to Sonoma. The route from Sacramento Valley is by State Route 6 from Sacramento to Napa, thence west to State Route 51 and five miles north to Sonoma.

The End

In Memoriam

Glenn B. Ashcroft

THE DIVISION of Architecture mourns the death on April 25, 1946, of Glenn B. Ashcroft, Senior Structural Engineer. Mr. Ashcroft was born October 28, 1874, in Ohio and was a direct descendant of Ethan Allen, famed Revolutionary leader of Vermont's "Green Mountain Boys." His technical training was obtained at the Case School of Applied Science and Baldwin-Wallace College. After graduation he worked for a time in Canada and in the Eastern United States, coming to California in 1907.

For many years he was a structural engineer with the architectural office of the late Henry H. Meyers of San Francisco and, while there, was identified with a number of California's prominent engineering and architectural works. He had been with the structural engineering section of the State Division of Architecture since January 6, 1930, except for a short period while in war work. Most of his service has been with the Sacramento office; however, after the Long Beach earthquake of March, 1933, he spent several years in the Los Angeles office of the division in connection with the reconstruction of earthquake damaged public schools. Although eligible for retirement in 1944, he was asked to remain to assist with the division's postwar program.

Mr. Ashcroft was a very active outdoor man who took a great interest in many subjects such as botany, geology, early California history, and native Indian relics. His wide fund of information made him an interesting companion on trips through California. When scraps of what seemed might be worthwhile historic or scientific facts came to him, he would patiently gather and match the shreds of information together until he had pieced out the whole story. In these searches he often turned up interesting relics, some of which may be seen at Sutter's Fort. The March-April number of "California Highways and Public Works" contained an article by him entitled, "Ancient Weather Map on U. S. Highway 40."

In one of his many-sided spare-time activities he made an English translation of the German technical reference book "Rahmenformeln" by Kleinlogel. This translation is still being used in the division. A certificated architect as well as a registered civil and structural engineer, he was a member of various technical and professional societies such as the Structural Engineers Association of Northern California, the Seismological Society of America, and the Engineering Institute of Canada. He was also a member of the Rosicrucian Order. He was married on October 21, 1902, to Emmy D. Poock who died in 1938. He is survived by a daughter, Mrs. Herbert H. Mensing, a son, William G. Ashcroft, both of Alameda, California, and two grandchildren.

QUAKES NOT SO POPULAR

By W. L. SAVAGE
Assistant Maintenance Engineer

IF THEY never experience another earthquake it will be just fine and dandy with the men of the maintenance department of District IX.

In addition to breaking the Los Angeles Aqueduct near Boulder Peak, eight miles south of Little Lake, Inyo County, causing the flooding of State Route 23, just north of the junction of U. S. 395 and U. S. 6, the earthquake shocks in southern Inyo and eastern Kern counties last March gave the maintenance crews of District IX a big job of removing rock slides from State Route 57, known as the Walker Pass Road, between Freeman Junction and Bakersfield.

The slopes adjacent to the roadway in this area, five to ten miles west of Walker Pass Summit, are dotted with large loose rock varying in size from small boulders to some possibly 100 tons in weight.

Following the first quake, much of this rock was loosened, rolled down the hillsides and was either deposited upon the roadbed or continued across and into the canyon below.

Holes were gouged into the pavement two feet in depth. Numerous wide cracks and fill settlements occurred in this area.

It was possible for cars to pass around or between the boulders, but the logging trucks using this route were unable to continue to travel until the rock was removed.

It was necessary to blast the larger rocks before they could be removed with a tractor.

The epicenter of the shocks was a location approximately 30 miles northeast of Weldon. Three distinct quakes were felt. The first beginning at 5.25, the second at 5.55, and the third at 6.03 a.m., on March 15th, each lasting approximately 30 seconds.

The 5.25 a.m. shock broke the Los Angeles Aqueduct near Boulder Peak about eight miles south of Little Lake, causing the 200 second-feet of water contained in 25 miles of the aqueduct to be released and poured down what is known as Nine-Mile Canyon crossing State Route 23, the Los Angeles to Reno highway.



These photos show some of the larger rocks which blocked State Route 57 following earthquake jolts

In Memoriam

Robert E. Svedeen

THE San Francisco-Oakland Bay Bridge regrets to announce the death of Robert E. Svedeen on June 3, 1944, while on active service in the United States Navy.

Mr. Svedeen was in the service of the State for only a few months, but during that time he made many friends, especially among those who were closely associated with him in his work. He worked with the traveling bridge painting crew for several months. On June 2, 1941 he went to the San Francisco-Oakland Bay Bridge as a structural steel painter, remaining in this position until called into the Navy on August 27, 1941.

Born in Los Angeles, March 28, 1913, he received his education in the public schools of that city and in Hollywood High School. He served in the Navy from 1930 to 1934, and thereafter worked as a painter on several jobs, including the original painting of the San Francisco-Oakand Bay Bridge.

He is survived by his widow to whom his former fellow employees extend sincere sympathy.

In Memoriam

Harry Scott McAlpine

HARRY SCOTT McALPINE, electrician employed on the San Francisco-Oakland Bay Bridge, passed away suddenly at work on April 11, 1946.

Mr. McAlpine was born in San Francisco on April 24, 1887. He attended the public schools and, upon graduation, chose the electrical trade for his profession. He was employed by various San Francisco contractors and also worked at intervals for several State agencies from 1931 to 1935, at which time he was appointed to a permanent position of journeyman electrician for the State on the construction of the San Francisco-Oakland Bay Bridge. He was transferred to maintenance on November 17, 1936, where he remained until his death.

Mr. McAlpine was a member of Fairmont Lodge No. 435, F. & A. M.; Fraternal Order of Eagles, and the Macabees.

Beloved by all who knew him, his untimely passing is deeply felt by his many friends and associates on the Bay Bridge and elsewhere who recognized in him a master of his profession.

He is survived by his wife, Alice, and two daughters, Wilifred McAlpine and Barbara McAlpine Anderson.

State Government Moves to Solve Critical Lumber Shortage

(Continued from page 2)

veterans housing and are even now actually making loans at the rate of $3,000,000 a month.

VETERANS' LOAN PROGRAM

"Our veterans' loan program to date has resulted in more applications from World War II veterans than were received from World War I veterans during the entire period from 1920 to 1941.

"The State has appropriated $7,500,000 to provide emergency housing for veterans. This was the amount recommended for the purpose by the Federal Government which pledged itself to spend $15,000,000 to move surplus structures into areas where a housing crisis existed. The State agreed to pay 90 per cent of the cost of making the houses livable and it was decided that local agencies would be asked to contribute the remaining 10 per cent. Therefore the State's appropriation makes possible the immediate expenditure of $53,250,000 for emergency housing. This does not include the cost of the buildings which would aggregate another $45,000,000.

"The State has made $8,000,000 available for housing at the University of California and the State colleges. The enabling legislation permits the issuance of revenue bonds and the raising of the actual total available to $16,000,000. In addition the State has provided $2,000,000 for emergency housing for agricultural workers.

"Totaling these figures we find the State Legislature has made available for housing expenditures some $171,250,000. This is without reference to the great reservoir of private funds available for investment in housing.

LUMBER SHORTAGE OBSTACLE

"Our difficulty is not a shortage of funds. Neither in public funds already authorized for expenditure nor in the field of private investment do we find the bottleneck which is stifling the building of homes. I have been assured that there is ready to be launched in this State whenever building materials are made available, the greatest home building program that has ever been undertaken in any State of the Union.

"The question is when building materials will be made available. It is paradoxical that our veterans cannot take full advantage of the opportunities gratefully extended to them due to material shortage. One of the short materials is lumber. There are those who will speak to you today who will tell us just how short lumber is. It should be our purpose to determine what part a lack of roads may play in that shortage and what can be done.

"For months State Government has been working on the problem presented by these bottlenecks and now believes that many of them can be broken through cooperative action on the part of all agencies and groups represented here today.

HOUSING SHORTAGE FIGURES

"While the problem we are met here today to consider primarily is that of inadequate highway transportation facilities, for the more rapid movement of lumber from forest to market, it might be well to quote some housing shortage figures which show the need for prompt cooperative effort to achieve an early solution of the basic problem involved.

"During the five-year period 1935-1940, a total of 300,000 new homes were constructed in California.

"The latest authoritative estimates of the Reconstruction and Reemployment Commission show that the immediate and urgent housing requirements of the State at the present time are 250,000 houses.

"It is conservatively estimated that 10,000 board feet of lumber are required for the average home. Multiplying this figure by 250,000 the minimum number of homes desperately needed in California at the present time reveals a pressing need for 2½ billion board feet of lumber.

"Actually it is estimated that with California's increasing population and the new requirements of the veterans a total of 625,000 homes will be needed in this State within the next five years. For this period the housing needs of Los Angeles County are estimated at 280,000 homes, of San Diego County 20,000, of the remaining Southern California Counties 25,000, and in the Northern California section 300,000 homes, of which 70 per cent are in the metropolitan areas of San Francisco, Alameda, Fresno, Sacramento, San Jose, and Stockton.

"Our pressing need for 2½ billion board feet of lumber for our immediate and urgent needs for homes looms larger in view of the estimates of total lumber production in the five major western lumber producing States. It is conservatively estimated that this production will run between 14 and 15½ billion board feet for all purposes. Only half of the lumber produced can be expected to be available for housing. It becomes obvious that unless the production of lumber can be increased the State of California is not going to get even its immediate and urgent requirements of lumber.

SITUATION IS SERIOUS

"The situation confronting us is serious. It calls for emergency action. The State Government has been cooperating with Federal and local agencies in the erection of emergency housing and I want to see the same type of cooperation translated into action on the lumbering problem. I am determined that the State will not overlook any opportunity to be of service. I hope we will be able to enlist the assistance of every group and agency that can help speed the movement of lumber to those sections of California now in such desperate need of building material.

"Of course we recognize that there are numerous other bottlenecks in home building construction material such as sheet rock, cast iron pipe, soil pipe, and other materials, but I think our chief concern here today is with the highway transportation bottleneck which is impeding the movement of lumber from forest to market.

"We do not hope to solve all our highway problems here today. We can now consider only our pressing needs for the immediate emergency. But we can through cooperative effort find a remedy which will assist us in meeting the urgent emergency needs of our lumber industry to which we must look for so much in this crisis."

FIRST TO LIGHT STREETS

Paris was the first city to have lighted streets. At about the beginning of the 18th century, the Paris police ordered every householder to keep a lamp burning in a street window from 9 o'clock in the evening through the night. A few years later, tallow-burning lanterns were suspended by chains at regular intervals along the centers of Paris streets.

Seal Coating on the Island of Guam

(Continued from page 25)

crushing plant which produced the seal coat screenings.

Excellent work was done by these battalions although they were composed of young men who had had little or no practical construction experience in civilian life. The average age of the members of the 109th Battalion was 19.1 years. Captain F. C. Bedell was the Officer in Charge of Construction at Guam, and Lieutenant Commander Thomas P. Cocke was in charge of the 109th Battalion.

TYPHOON SCARE

Native villages, although out of bounds without a pass, were quite picturesque, especially those at the south end of the island which were the least damaged by the reoccupation maneuvers. Many of the native villages in the central part of the island had been rebuilt, but palm thatch and coconut logs had given way to corrugated metal and cut lumber.

During my stay on the island all construction activities were brought to a standstill by a typhoon. First warnings of the approaching storm which originated in the vicinity of Truk to the southeast, were received on a Thursday morning. Its center was expected to pass between Guam and Saipan some 100 miles to the north and winds of moderate intensity were predicted. The velocity of the wind increased throughout the morning of that day, and by noon all but essential work was stopped and outfits were confined to camps.

On Friday it was learned that the path of the storm had shifted towards Guam and men who had gone through the typhoon at Okinawa in 1945 openly expressed their dread of a similar experience.

PREPARE FOR BLOW

When it became apparent that the island was in for a real blow, all hands fell to the job of staking down as much of the camp as possible. Battalion records were deposited in bomb proof shelters, personal gear stowed in the strongest warehouse buildings, and a number of quonset huts in the nearby hospital area were lashed to pole anchors hastily set by telephone crews for use by enlisted personnel.

Up in the "officer's country" heavy asphalt trucks, line trucks, and tractors were parked between the tents to act as wind breaks and serve as anchors for lines thrown over the tent peaks.

Elsewhere on the island, outfits actually "dug in" with power shovels for protection, and much of the native population was transported by bus to caves. Many of the ships in the harbor put to sea to avoid the possibility of being blown aground.

TIDAL WAVE MISSES GUAM

Strong wind from the northeast accompanied by rain, lashed the camp all during the fore part of Saturday. Some tents collapsed and a number of unoccupied quonset huts were shifted from their foundations of coconut logs. Shortly before noon, the island radio station WXLI announced that the storm had reached its maximum about 10 a.m., and that the center had passed, on its westward course, about 50 miles south of the island. Official sources reported a maximum wind velocity of 63 knots per hour.

As the storm subsided a sigh of relief went up from even the hardiest of those Navy men, as severe damage to the great warehouse area at Apra Harbor would have meant months of additional work and cancellation of that long anticipated trip home. Only two days were required to reorganize the camp and rebuild damaged facilities.

Work returned to normal on a Tuesday only to be abruptly interrupted that afternoon by an official radio report that a tidal wave was expected to strike the island within an hour and all hands were ordered to high ground. Within a few minutes roads within the dock and warehouse area were jammed with everything that would roll towards the hills. Although precautions were taken that night to move all outfits to high ground, the tidal wave which wrought such severe damage at Hilo in the Hawaiian Islands failed to materialize at Guam.

Wife—"I heard you talking to yourself while you were taking your bath, John. That's a bad habit."

Husband—"I wasn't talking to myself; I was talking to the soap. I slipped on it."

"Why so melancholy?"

"My girl rejected me last night."

"Well, buck up. There are plenty more girls."

"Yes, I know. But I feel so sorry for her."

DONNER CENTENNIAL

(Continued from page 7)

living in 1918, and where she died at the age of nearly 79 years, February 19, 1922.

REED'S PART IN EXPEDITION

Martha Jane (Little Patty) Reed Lewis was the younger of the two daughters of Jim Reed who was one of the original leaders of the party. Reed, because of an incident leading to the death, by his hand, of one of the members of the party, was banished shortly after the party left the vicinity of Salt Lake and proceeded ahead to California from whence he subsequently took a prominent part in the rescue of the survivors, including the members of his own family.

Reed was an able and upright man. Regardless of the merits of the case which resulted in his banishment and the subsequent identification of the name "Donner" as the sole title of the expedition, and the application of that name to the trail and the historical names and monuments related thereto, the Reed family and their supporters always felt that any references should have been to the "Reed-Donner" Party rather than confined solely to the name "Donner."

It is 28 years since the Pioneer (Donner) Monument was dedicated. On March 22, 1922, military aviators, piloting four airplanes, crossed the Sierras for the first time, flying from Mather Field to Reno in one and one-half hours.

Following is an extract from a contemporary newspaper account of the event:

"THE PAST—THE PRESENT"

"The route traversed by the big airplanes today is not far from the one along which the early Californians entered the State during the days of the gold rush.

"Wagon trains often spent more than a week in crossing the mountains to the Sacramento Valley over the crude roads of those days. Of recent years with improved road conditions the trip from Sacramento to Carson has consumed three days for freight teams. The one way trip between the two cities has been a good day's work for the ordinary automobile."

Compare the above with today's schedule of less than four hours by auto and one hour by plane.

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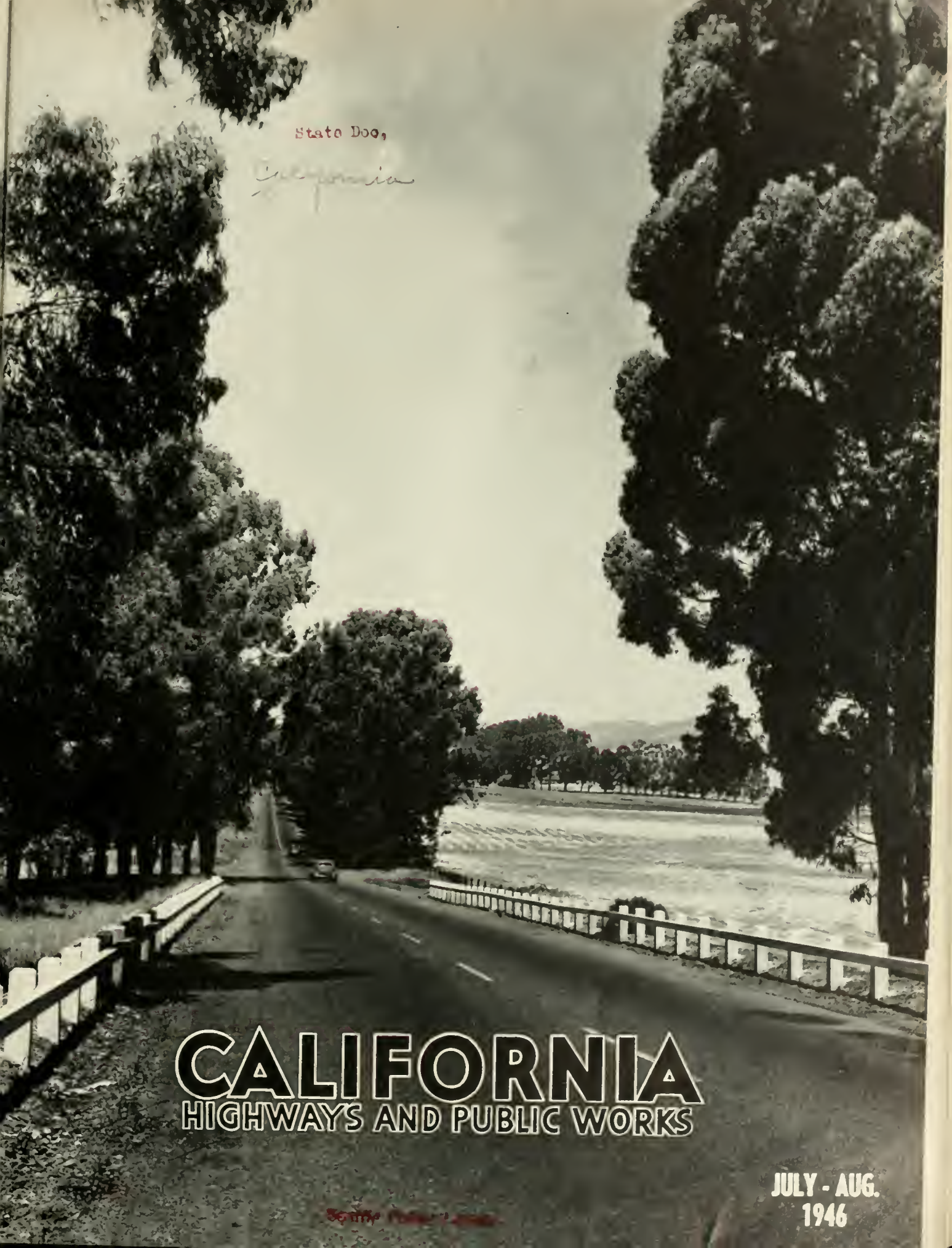
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C. H. PURCELL, Director GEORGE T. McCOY, State Highway Engineer K. C. ADAMS, Editor

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Work of Division of Highways During the Last Fiscal Year

By G. T. McCOY, State Highway Engineer

THE completed fiscal year which ended June 30 was of more than ordinary importance to the California Division of Highways as the end of the war marked a distinct change in the activities of the department.

From the rush of wartime construction of access roads and bridges for the Army, Navy and other Federal agencies the State was faced with the postwar problem of rehabilitation and development of a deteriorated highway system.

To make a start on the postwar program, work totalling $82,047,600 was put under way by the Division of Highways between July 1, 1945 and June 30, 1946.

This unusually large volume of work for a single year was made possible by the reserve of State highway funds accumulated during the war years and $17,000,000 of postwar Federal aid.

The value of this work is the largest ever initiated in a single year by California's State highway organization.

Of the $82,000,000 total, work orders for construction off the State highway system, on access road improvement performed for Federal agencies and on county roads being improved under the Federal Aid Secondary program, amounted to $7,600,000, leaving an amount of nearly $74,500,000 in work on the State Highway System.

Broken down to the several functions of the department's principal activities, the $82,000,000 is composed of $64,970,000 for construction, right of way, and construction-engineering phases of the work, $13,906,700 for maintenance, $2,316,500 for preliminary engineering and $854,400 for operation and maintenance of the San Francisco-Oakland Bay Bridge.

Progress in development of the California State Highway System toward standards which will serve more adequately the demands of the rapidly increasing traffic, is indicated mostly by the $64,970,000 in work orders written for the construction phase. Comprising this figure are totals of $54,907,700 for construction and repair operations, by both contract and day labor, and construction engineering, and $10,062,300 for right of way costs.

The improvement to be accomplished to roads in the State under this $64,970,000 include construction of 266 miles and repair to 506 miles, or total work on 772 miles during the war. Of the 266 miles of construction, 187 miles were located on the State Highway System, 24 miles were access roads built for the U. S. Army and Navy and 56 miles were county roads included in the Federal Aid Secondary System.

Also financed under construction activities was the building of 72 bridges and major repairs to 14 others. Of the 72 bridges constructed, four are located on access roads, one on the Federal Aid Secondary System and 67 on the State System. Thirty-one highway and railroad grade separation projects were also let to contract, of which 28 are on the State Highway System and three are on Federal access road projects.

The financing of postwar highway construction is based upon estimated revenues from the State sources of motor fuel taxes and registration fees and from Federal apportionments of funds appropriated by Congress for postwar aid to the States in improving the rural and urban sections of the Federal Aid System. For each of the three years California receives an annual apportionment of $17,000,000 for these two Federal aid purposes. As customary, the Federal funds must be matched with State highway dollars.

In addition to these funds for improvement to the Federal Aid System, California is apportioned $5,000,000 during each of the three postwar years, for improvement to a Federal Aid Secondary System. In California, the Federal Aid Secondary System has been selected from the several county-road systems through collaboration between county supervisors, the Division of Highways, and the Public Roads Administration.

The funds necessary to match the Federal Secondary apportionments to California were provided to the counties by a $12,000,000 appropriation made by the State Legislature in 1945. The statute appropriating these funds stipulated that 87½ per cent of the Federal secondary apportionments be used for improvement to county roads which the Public Roads Administration would approve for inclusion within the Federal Aid Secondary System.

Among the larger and more outstanding improvements to State highways inaugurated during the last fiscal year, are included the following major development projects:

Construction on new alignment of U. S. 101 from San Jose southerly to Ford Road. This improvement to four-lane divided highway standards involved four contracts including grade separations at Santa Clara Street in San Jose and Coyote and Ford Roads

(Continued on page 23)

State Highway Heads Coming to California

THE American Association of State Highway Officials comes to California again this year for its annual meeting.

The convention will be held in Los Angeles December 17-20. Highway officials from all of the 48 States and from Alaska and Hawaii are expected to participate in the session. The Association held its last far-western meeting in San Francisco in December, 1936.

Preliminary plans for the convention are being made by a program committee appointed by the president of the Association, M. J. Hoffman, State Highway Commissioner of Minnesota.

George T. McCoy, State Highway Engineer of California, is chairman, and serving with him are Dr. L. I. Hewes, Chief, Western Region, Public Roads Administration; C. B. Shain, Director of Highways of Washington; and R. A. Allen, State Highway Engineer of Nevada.

Liability Insurance as Related to California Highway Contracts

KENNETH A. KEYES, Assistant Engineer

AS A general policy, the California Division of Highways does not specify that contractors furnish public liability and property damage liability insurance as a prerequisite part of contracts for the construction of highways and bridges on the State Highway System. However, in the construction of railroad grade separation structures, the railroad companies have insisted that, because of the magnitude of the risks involved, they be given adequate protection.

This protection first took the form of indemnity agreements executed by the contractor and backed by so-called "save harmless bonds," guaranteeing that the contractor and a bonding company as co-surety, would indemnify the railroad for any expense or liability in the case of an accident. This "bond" form of protection to the railroads was used in State highway contracts until January 27, 1937, when the Federal Bureau of Public Roads, now the Public Roads Administration, under a general memorandum for the U. S. Works Program prescribed that on all grade separation projects, financed with Federal funds, the railroad must be protected by standard liability insurance. The regulation established at that time is still in force and in general use throughout the United States.

THREE TYPES OF INSURANCE

This regulation requires that a contractor performing work in connection with railroad grade separation structures be required to furnish the following three types of insurance:

1. Contractors' public liability and property damage insurance covering all accidents occasioned by work under his direct control.

2. Contractors' protective public liability and property damage insurance protecting the contractor from accidents in connection with work being performed for him by subcontractors on the project.

3. Contractors' protective public liability and property damage insurance specifically protecting the railroad company in any accident arising from the construction work.

By far the greater portion of highway-railroad grade separation work is financed with Federal funds; however, as the various railroads insist on protection for all work in proximity to their property, insurance similar to that specified under the 1937 Federal Memorandum is also required of contractors on contracts financed with other than Federal funds.

SUBCONTRACTOR'S INSURANCE

The amounts of insurance that are required vary in accordance with the magnitude of the risks and are determined by agreement between the State and the railroad for each project. In general, the minimum requirement for public liability insurance is $100,000 per person and $200,000 per accident and for property damage liability the coverage is $25,000 per accident and $50,000 aggregate per job or policy period.

In order to complete the insurance protection, subcontractors, where insurance is specified, are required to carry the direct coverage outlined under Item 1 above.

Because the various insurance companies, in furnishing this protection use adaptations of their standard forms, in which some of the hazards encountered in highway construction are often excluded, it has been necessary to require that certified copies of all insurance policies be submitted for approval with the contract documents. The nonacceptable exclusions include hazards due to blasting, excavating of foundations, the use of automotive equipment and in some cases all damage caused by work on streets and roads.

OVERSIGHT CAUSES DELAY

In order to assure full compliance with the State's obligations and agreements with the railroads, all policies must carry a certification that the State shall receive a minimum of five days' prior notice, mailed by registered mail to the Department of Public Works at Sacramento, of any cancellation or reduction in coverage afforded by the policy. This is not an unusual stipulation and is found as a contract requirement in many contracts where the hazards justify an insurance requirement for construction work.

One of the principal troubles encountered in connection with liability insurance is that the endorsement providing this certification is very often overlooked when the policies are submitted by contractors. This oversight always causes delay in contract approval by the State's attorneys.

Another recurring problem involves the insurance provided for property damage by automotive equipment as a number of insurance companies separate the automotive property damage liability from other property damage liability. In these policies the automotive coverage is usually limited to a lesser amount, often $5,000, per accident and though no aggregate limit is placed on the number of accidents covered, the State's agreements will not permit acceptance of a lesser limit per accident and such policies must be revised to meet the contract minimum (usually $25,000 per accident and $50,000 aggregate) before they can be approved.

PROCESSING PROBLEMS

One underwriter has recently taken the stand that its policy written with the automotive coverage separated from and in lesser amount than non-automotive coverage would cover any accident on the job site. However, the State's attorneys have ruled that automobile coverage at the job site must be definitely covered in the full amount by a direct commitment in the policy in order for the State to fulfill its insurance obligations.

The greatest problem is in processing insurance required of subcontractors. These concerns, often performing very minor portions of the work, or working on the completed deck of an overhead crossing or pavement of an undercrossing, find that the minimum requirements apparently exceed the value of the work or apparent hazard involved. The fact is overlooked that the primary reason for the insurance is to provide protection for the railroad, where, because of the number of people that may be involved, the total liability in an accident is greatly increased.

(Continued on page 25)

Relics of Pioneer Highway Days Found

M. J. WRIGHT,
Surveyor-General and Ex-officio Register
State Land Office

F. E. WRIGHT, Deputy

STATE OF CALIFORNIA,
OFFICE OF
SURVEYOR-GENERAL
AND
REGISTER STATE LAND OFFICE.

Sacramento, April 11th, 1895.

This is to certify that at a meeting of the members of the Bureau of Highways, viz: Marsden Manson, Joseph Lees Maude and Richard C. Irvine; held in the office of the State Surveyor General this 11th day of April 1895 at 11.30 a.m. under Section 7, Chapter CCIII, of the Act Approved March 27, 1895.

Marsden Manson was unanimously elected Chairman of said Bureau.

M. J. Wright.
Surveyor General.
By, F. Wright, Deputy.

FIFTY-ONE years ago, the California Legislature created the State Bureau of Highways. Governor James H. Budd appointed as members of the Bureau, R. C. Irvine, Sacramento, Marsden Manson, San Francisco, and J. L. Maude, Riverside.

On April 11, 1895, the then Surveyor General, M. J. Wright, certified that the bureau had held its first meeting and elected Mr. Manson chairman. On that same date, the bureau chose

Mr. Irvine as its temporary secretary and the first minutes of the new agency were duly recorded in longhand by Commissioner Irvine.

Recent expiration of a State lease on an old warehouse in Sacramento and the resultant move required sorting of many cases of dusty and yellowed documents stored there by the State Engineer many years ago. Among these musty records, engineers of the Division of Highways unearthed the original certification of Surveyor General Wright and the large minute book in which for several years the records of the Bureau of Highways were painstakingly written with a pen. The certificate of the Surveyor General and the first page of the minute book are herewith reproduced.

Through the years, with many legislative changes, there have evolved from the old Bureau of Highways the present Division of Highways of the Department of Public Works and the California Highway Commission.

In 1895 the first link of the magnificent State Highway System of today was acquired. The Legislature designated the Lake Tahoe Wagon Road, one of California's pioneer stage toll roads, as a State highway, and from this humble start there was developed the California highways system totaling 14,000 miles of paved public roadways serving every section of the State.

Over the historic Lake Tahoe Toll Road flowed the varigated travel of pioneer days. It began near Smith's Flat, three miles east of Placerville, and extended easterly to the State line, a distance of 65 miles. History records that on this old route between Placerville and Carson City and Virginia City, there were 93 hotels and the Pioneer Stage Line employed 50 men and used 600 horses.

Today thousands of motorists travel yearly over this same highway, U. S. 50.

During 1895 and 1896, Commissioners Irvine and Maude, purchasing a team of horses and a buckboard wagon, drove into every county of the State. They covered 7,000 miles along the coast, through valleys, mountains and deserts, and on November 25, 1896, submitted to the Governor a report recommending a system of State highways "traversing the great belts of natural wealth which our State possesses, connecting all large centers of population, reaching the county seat of every county, and tapping the lines of county roads so as to utilize them to the fullest extent."



Pioneer State highway engineers constructed a route, now U. S. 40, over these granite heaps between Emigrant Gap and Donner Summit

"In submitting this report," says the late Ben Blow in his excellent work, '*California Highways*,' "the Bureau of Highways prepared and filed therewith a map of the proposed highway system which in its main features corresponds almost exactly with the California Highway System of today and discloses a breadth of vision that saw and pictured what now is practically an accomplished fact, in all fairness entitling Messrs. Irvine, Manson and Maude to that respectful appreciation so seldom granted to the men who pioneer the way; for they left behind them footprints which lead up from the mist of the early '90's to the present when on every side smooth vistas of roads serve to help humanity advance."

The Legislature of 1897 dissolved the Bureau of Highways and created a Department of Highways of which Marsden Manson, J. R. Price and W. L. Ashe were appointed commissioners to serve for two years, at the end of which time their offices automatically should cease and all powers attached to them be vested in one man, who must be a civil engineer, to be appointed by the Governor and hold office for four years.

The members of the new Department of Highways devoted their efforts to an exhaustive study of road construction practices and economics. Mr. Manson made a tour of Europe to observe the methods followed in England, France, Germany, Russia and other countries.

At the close of the two-year period of activity of the three commissioners, Mr. Maude, of the original Bureau of Highways, was appointed to the office of Highway Commissioner.

Motorists of today surely will find occasion to reflect upon the tremendous advance in modern transportation if they will read an essay, "The Effect of Roads Upon Industrial Development," written by Mr. Irvine and published in a bulletin of the Bureau of Highways in 1896, in which the author said:

> "The influence of the bicycle upon this agitation for improved highways can not be overestimated. Millions of dollars have been invested in the manufacture of these easy and graceful machines of locomotion and this agitation for better roads is due more directly to the efforts of the wheelmen than to any other one cause."

Last year more than 3,000,000 motor vehicles were licensed by the State of California and visiting motorists by the thousands joined the owners of State licenses in using the great system of highways planned 51 years ago by men who had the bicycle riders of that day in mind.

Thursday, April 11, 1946

A meeting of the Bureau of Highways was held in the Capitol Room 231 on this date, Commissioner Maude presiding.

Upon roll call it was found that all the members of the Bureau were present.

A resolution was introduced by Commissioner Maude to the effect that Commissioner Irwin act as temporary secretary.

Upon roll call the vote was as follows: Ayes: Commissioners Irwin, Maude and the Chairman.

The Chairman declared the resolution adopted.

Letters to General Roy Stone, Gov. Budd, Atty. Gen. Fitzgerald, State Prison Directors, in reference to the organization.

A resolution was introduced by Commissioner Maude to the effect that the following letters be written and sent out. One to General Roy Stone of Washington notifying him of the organization of the Bureau of Highways, another to His Excellency Governor James H. Budd to the same import, another to the State Prison Directors advising them similarly, and another to the Attorney General requesting an opinion as to when the operations of the Bureau can be commenced all of which letters should be made part of the records of the Bureau.

Upon roll call the vote was as follows: Ayes: Commissioners Irwin, Maude and the Chairman.

The Chairman declared the resolution adopted.

Form of letter to applicants for Clerkship.

Consultation with Prison Directors

A resolution was introduced by Commissioner Maude to the effect that Commissioner Maude be appointed a committee of one to consult with the State Prison Directors.

Upon roll call the vote was as follows: Ayes, Commissioners Irwin, Maude and the Chairman.

The Chairman declared the resolution adopted.

No reply from Atty. Gen.

A resolution was introduced by Commissioner Irwin to the effect that the Bureau adjourn subject to the call of the Chair.

Upon roll call, the vote was as follows: Ayes,

Four-Lane Highway Construction on El Camino Real in Monterey County

By V. E. PEARSON, Associate Highway Engineer

THE first step in the correction of a congested section of U. S. Highway 101 was initiated with letting of the contract for construction between Santa Rita and 0.8 mile north of Crazy Horse Summit in Monterey County, a total length of 8.4 miles.

This is the first of two projects contemplated to develop the Prunedale Cutoff into a four-lane divided highway by widening so as to add two lanes separated from the existing two lanes by a central dividing strip. The project will cost approximately $830,000.

The present two-lane highway which was opened to traffic on July 20, 1932, supplanted the narrow, twisting San Juan Grade which increased speed and volume of traffic had made obsolete after 17 years of service. Continued increase in traffic on this main route along the coast between the metropolitan areas of San Francisco and Los Angeles resulted in the traffic on this stretch rising from three to four thousand vehicles daily in 1932 when it was opened to traffic to six to nine thousand vehicles in 1941, of which over 10 per cent are trucks and trailers.

TRAFFIC SLOWED

Congestion is at present caused by the slowing up of trucks on the rolling grades, thereby holding up the faster moving automobiles and creating definite driving hazards if safe driving rules are not followed. It is the policy of the State Division of Highways to correct such situations as rapidly as possible.

Construction crosses several unstable marshy areas composed of saturated unstable clayey sand, soft plastic clay and peat to depths of from three to 14 feet. These areas are being treated in a manner similar to that employed during the original construction which was successful in stabilizing the areas as evidenced by the absence of any appreciable settlement in the existing roadbed.

This treatment consists of excavating the saturated unstable material to the underlying hard pan, placing it in piles to dewater, installing 8-inch perforated metal pipe underdrains

(Continued on page 32)

This view shows widening activities and existing two-lane roadbed on right





Mississippi wagon used to haul excavation materials involving hauls up to two miles

View of embankment construction activities showing piles of material excavated in treatment of fill area



Life on San Francisco-Oakland Bay Bridge Has Its Drawbacks—For Those Who Work There

WE pulled off to the side of the road by the toll plaza building of the San Francisco-Oakland Bay Bridge the other day and dropped in on the folks who keep more than 2,000,000 cars rolling across the bay every month.

We found a hard-working, harried group of citizens who come to work each day to wrestle with a problem that is somewhat like sending Junior off to his college classes in the clothes he outgrew in the low seventh grade. In a recent month, 2,202,000 cars passed through the toll plaza that was designed to accommodate a maximum of 1,600,000.

The bridge people are convinced we need a new bridge—but quick. And they also are planning to build new toll stations and lanes around the north side of the plaza building. If they get enough new lanes, all stations will collect your money from the driver's side of the car. At any rate, they'll route all lower-deck traffic around the north side.

* * * *

From Toll Captain Minor L. Silvey and Principal Bridge Engineer Howard C. Wood we learned much of the life and labor of the bridge staff.

For instance, we learned that Sunday no longer is the big day of the week for bridge traffic. The top load, for some months now, has come on Friday. Apparently, what with unlimited gas and such, many San Franciscans are scooting out of town on Fridays for the weekend, while traveling salesmen are scurrying back into the city to file their expense accounts, mow the lawn and get acquainted with the family at home.

The bridge's all-time high, however, came last Easter Sunday when 79,016 cars rolled across the bay.

Women toll collectors, the captain told us, are becoming more or less extinct, what with returning veterans reporting back on their old jobs.

During the war, he hired between 200 and 300 of them. Fifteen are left and only two of these have permanent civil service appointments to the toll squad of 57 collectors and 14 sergeants. Collecting was rugged work for the women and few could take it for long. Some male motorists seemed to achieve great satisfaction in barking lewd and lascivious cracks into their tender ears, then speeding away.

Others had a charming habit of trying to hold hands with the girls when they paid their toll. Some even pulled the women to their cars for a try at a little concentrated rough stuff.

Then there was a group of correspondence Casanovas, more harmless but mighty bothersome. They'd write notes giving their address or phone numbers and impassioned pleas for dates, wrap them around their quarters and hand them to the girls.

* * * *

Many collectors handle more than 4,000 automobiles a day, yet the average error rate among all the collectors is a mere 21½ cents per $1,000. (Their cash must tally with an electric car-counter.)

We also learned, during our visit, the reason why (during off-peak periods) you sometimes find toll stations on the right-hand side of your car operating while the more convenient left-hand stations are unmanned. It isn't, we learned, because the bridge people want you to stretch.

It's because collectors on what the trade calls "on-side," or left-hand stations, handle so many cars at such a rapid rate they get punchy and will foul up their cash, cut paper dolls and start yodeling in high Hindustani unless they receive 15-minute rest periods every once in a while.

And, we were told, the monetary confusion would be something akin to a Washington budget discussion if they switched an "off-side" collector away from his cash, had him suddenly take over the money and station of an "on-side" collector during the relief period, then switched him back to his own station.

* * * *

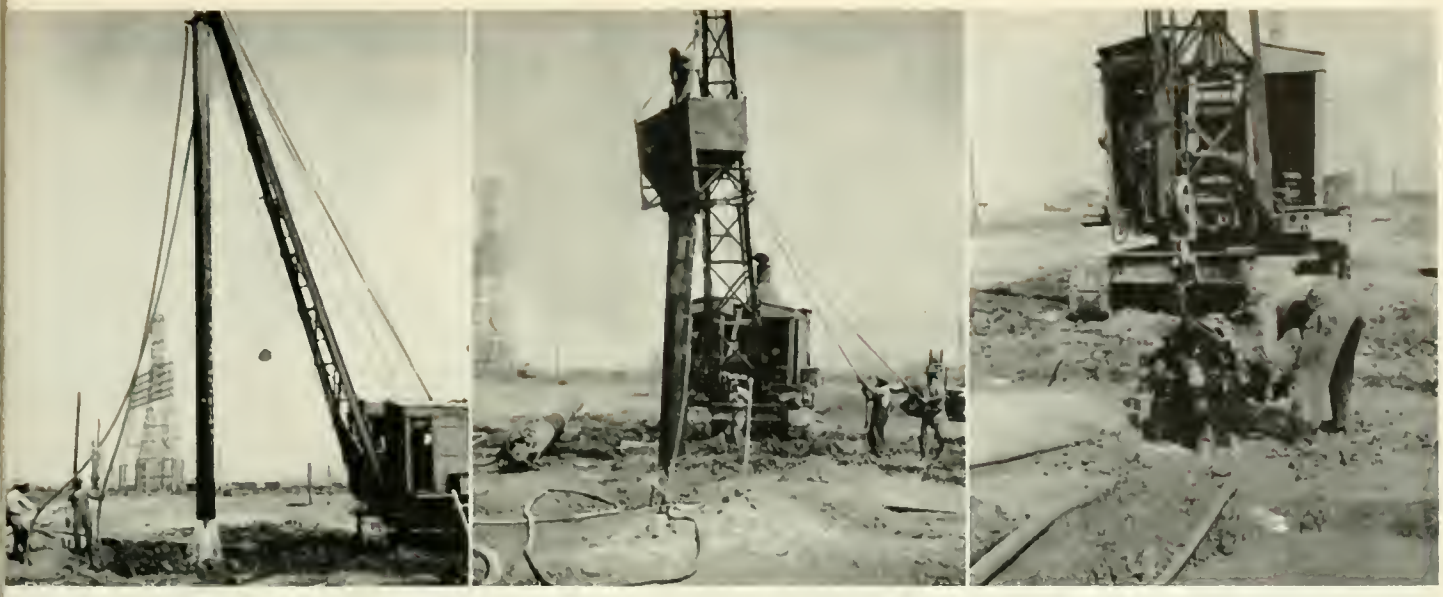
One of the biggest headaches is stalled cars, despite the fact the new $5 penalty for running out of gas has cut the no-fuel cases in half. On Easter Sunday, for example, tow-cars were called out 86 times. On last month's lightest traffic day there were 52 service-car alarms. And, the bridge people explain, all traffic in one direction immediately drops 33⅓ per cent when a single stalled car blocks one of the three lanes. Within a few moments, the load in that direction suffers a 40 per cent drop because of increased traffic in the remaining lanes.

The bridge, incidentally, is real chivalrous about women and will change a tire for a stalled gal without charge. Rate for men: 50 cents.

Captain Silvey would like us to remind you, too, that those red alarm boxes every 1,000 feet are dual purposed. Break one little glass window and a tow-car will rush to your aid. Break the other glass if you want the fire department.

* * * *

Saddest note is that the bridge people clear away most of the stalls and wrecks so quickly that only a few of the delayed motorists see what caused the traffic jam. So they blame it all on slow toll-taking and bawl hell out of the collectors when they reach the plaza.—*Jack S. McDowell in the San Francisco Call-Bulletin.*



Left—Outer and inner casing with jets in operation. Center—Loading sand in outer casing. Inner casing in left foreground. Right—Preparing to pull inner jet casing from outer casing

Embankment Stabilization at Terminal Island

RELOCATION of a portion of Pacific Coast Highway (formerly State Street) and its construction as a freeway to carry the highway over the Terminal Island Freeway, the tracks of the Union Pacific Railroad, and the tracks of the Los Angeles City Harbor Department on separation structures, was started in June. A crossing of Dominguez Channel, a Los Angeles Flood Control Channel, and relocation of a portion thereof also is necessary.

Because of the unsettled nature of the area through which this highway passes—settlement of 0.2 feet to 0.4 feet during 1941-43 has been recorded—the high embankments require the installation of vertical sand drains to puncture impervious strata and tap the water storage in the pervious layers.

The water storage is being tapped in order to minimize the increase in water pressure which is anticipated due to the added load when embankments are constructed. Such increase in water pressure in material of the type found in the many-layered formation throughout this project tends to cause a lateral flow of material.

The controlled rates of construction of the embankments are one foot per day or three feet per week maximum.

Sand drain construction is the first operation on this project. Several methods of constructing the holes, in some cases to be 50 feet deep, have been studied, and tried.

The method adopted on this project is to sink a casing and jet the material out, around the outside of the casing. After the holes have been completed, they are backfilled with a clean coarse-graded sand to allow for the upward passage of water.

A two-foot layer sand-blanket is to be constructed full width of embankments to permit lateral escape of water rising from sand-filled drains.

James I. Barnes Construction Co. is the contractor. Frank B. Cressy is Acting District Construction Engineer and W. D. Eaton is Resident Engineer, both for the State.

PROJECT COST $14,000,000

The Terminal Island Access Road Project is being financed by the Navy at a cost of $14,000,000. Its outstanding feature is a vertical lift bridge spanning Cerritos Channel, replacing the old swing bridge.

Situated alongside the still serviceable bascule bridge, the new structure will afford a direct route for the Terminal Island Freeway as well as permit unhampered navigation in Cerritos Channel. It will allow navigation a clearance of 50 feet above high water when the lift is at roadway grade, and 125 feet when the span is raised to its maximum lift. Thus, with a channel of 35-foot depth and a maximum clearance above water of 175 feet, the needs of practically all types of modern vessels are provided for.

The lift bridge proper will consist of three channel spans and 42 approach spans, 26 on the south side and 16 on the north. The lift span is 240 feet in length, between bridge seats. The north and south spans, excluding towers, are each 184 feet.

The total length of the bridge and approaches is 4,000 feet, measured between Seaside Boulevard and Station 50. The three bridge spans are of steel truss design of the Warren subdivided type, with split panel points, a through truss bridge of standard design. Approach spans will be constructed of steel plate girders on reinforced concrete columns. The viaduct spans will be supported on four-post bents resting on continuous footings and 35-foot piling.

BRIDGE PLANNED BY STATE ENGINEERS

Plans for the bridge were prepared by the State Division of Highways under the direction of F. W. Panhorst, State Bridge Engineer, and J. W. Green, Southern Representative of the Bridge Department. State highway, bridge, and Navy construction were coordinated with the railroads and oil companies involved by S. V. Cortelyou, State Highway District Engineer, and



Left—Placing sand in outer casing from sand hopper. Center—Jetting casing into position. Right—Removing inner jet casing from outer fill.

A. D. Griffin, Assistant District Engineer.

The roadway of the bridge and approaches will be of standard State highway design and will consist of two 35-foot lanes divided by a five-foot strip, with two three-foot sidewalks for maintenance crews.

State Highway contracts for four important structures and over two miles of highway have been let by the Division of Highways with a view to completing the Terminal Island Freeway between Seaside Boulevard and Willow Street. Including the Navy's vertical lift bridge across Cerritos Channel, all portions of the route have been contracted for except a 400-foot strip between Seaside Boulevard and the south approach to the Cerritos Channel Bridge, and a 1,300-foot section on the north side of the channel between Station 44 and Station 57. These two sections will be let by the Navy.

CONTRACTS AWARDED

North from Station 57 (toward Los Angeles) Macco Construction Company of Clearwater has a contract with the State for paving about 2.1 miles of the Terminal Island Freeway with asphaltic concrete. This portion extends from Henry Ford Avenue to Willow Street, and will cost $1,141,080. The work involves 58 acres of clearing and grubbing, 14,500 cubic yards roadway excavation, 23,500 cubic yards structural excavation, 4,700 cubic yards ditch and channel excavation, 144,000 lineal feet vertical sand drain holes, 16,500 tons sand backfill (drains), 680,000 tons imported borrow, 72,000 tons imported subgrade material, 125,500 square yards preparing Class C subgrade, 290 tons RC-2 liquid asphalt (bituminous surface treatment), 24,000 square yards prepare, mix, and shape surface (bituminous treatment), 540 tons plant mix surfacing, 50,500 tons asphaltic concrete, 330 cubic yards concrete (pavement base), 720 cubic yards concrete in structures, 315 tons gravel backfill, 400 lineal feet rubber water-stops, 410 cubic yards Class C concrete in pipe reinforcement, 34,500 lineal feet chain link fence, 15 gates, 10,520 lineal feet 18-inch to 66-inch reinforced concrete pipe, 50,000 pounds bar reinforcing steel, 35,000 pounds miscellaneous iron and steel, and 145,000 plants for bank protection, pumphouse and pumping equipment.

Macco Construction Company was also awarded a contract by the State for constructing an overhead crossing on the freeway over the tracks of the Union Pacific Railway. This structure is located in the City of Los Angeles. The estimated cost is $599,121.

The project will involve 5,960 cubic yards of concrete, 2,743,000 pounds of structural steel, 1,024,000 pounds reinforcing steel, 53,950 lineal feet of timber piling, 3,224 feet steel piling, and 2,250 feet of steel railing.

At Anaheim Street, the State is constructing a steel overcrossing to carry the freeway over the tracks of the Union Pacific, Southern Pacific, and Pacific Electric Railroads. This contract was awarded to the E. W. Elliott Construction Company of Lynwood, on April 18, at $849,357.



Removing outer casing and backfilling with sand. Note displacement of water by sand backfill.

The work involves 9,000 cubic yards of structural excavation, 8,300 cubic yards Class A concrete, 4,049,000 pounds structural steel, 75,160 feet timber piles, 3,770 feet steel piles, 1,622,000 pounds reinforcing steel, and 3,566 lineal feet of steel railing.

Oberg Bros. of Inglewood have the contract at $264,297 for constructing

(Continued on page 29)

Two Postwar Highway Projects on U.S. 40 In Solano County Are Well Under Way

By P. O. HARDING, District Engineer

THE first two postwar projects to get under way in District X are located on State Route 7 (U. S. Highway 40) between Vacaville and north of Dixon.

The first project from Vacaville to Midway, a distance of 6.02 miles, was advertised for bids to be taken November 28, 1945. The second project, from Midway to 1.3 miles north of Dixon, a distance of 6.13 miles, was advertised for bids to be taken on December 19, 1945. The same contractor was the low bidder on both of these projects.

We, therefore, have 12.15 continuous miles of limited access freeway on nearly straight alignment under construction at the same time by the same contractor, Fredrickson Brothers of Emeryville, California. Each project is approximately the same length. Both projects are under the supervision of the same Resident Engineer, George R. Hubbard. Two major stream crossings are involved on each project with the same representative of the Bridge Department, G. A. Crayton, in charge of major structures. Both sections naturally carry almost identical volumes of heavy traffic requiring concrete pavement construction.

TWO SEPARATE PROJECTS

In contrast to the many common features of these two projects they are not the same in many respects. The first contract between Vacaville and Midway Corners involves the construction of two new lanes which, with the existing two traffic lanes, will provide a four-lane divided highway. The second contract is on entirely new alignment and involves the construction of the complete four-lane divided highway requiring, in effect, double the amount of construction for the same length of highway.

The first project from Ulatis Creek in Vacaville to the junction with the old original highway east of Vacaville is located in rugged terrain involving the widening of existing heavy cuts and fills. This section of road, some three-quarters of a mile in length, required widening on the northerly side with a center division strip 12 feet in width. The remainder of this project involves the construction of two new lanes on the southerly side of the existing road with a minimum width of center division strip of 36 feet.

DIVISION STRIP

For a distance of approximately a mile within this section the two sides of the highway are separated by a division strip of variable width with a maximum separation of approximately 136 feet, this variable spread being caused by the location of a creek in the division strip acting as a natural barrier between the two sides of the road. Pine Tree Creek from the north crosses the existing State highway making a right angle turn to the east paralleling the existing State highway on the southerly side for a distance of approximately one-quarter mile at which point it merges into Horse Creek from the north which continues parallel on the southerly side of the existing road some 0.8 mile before it veers southeasterly away from the highway.

About 700 feet westerly from the latter point another branch of Horse Creek enters it from the north across the existing road, at which point the project calls for the construction of a new bridge over the new two lanes and a channel change located entirely south of the new highway to provide the proper connection with Creek as it angles southeasterly from the project.

TWO BRIDGES ON PROJECT

The new Horse Creek Bridge has a total length of 86.54 feet consisting of a center span of 23 feet with two 15 feet approach spans on either end, all being constructed on a 45-degree skew. Approximately two miles easterly of Horse Creek the highway crosses Gibson Canyon Creek with a right angle crossing requiring a bridge length of 89.5 feet consisting of three central spans of 19 feet and two end approach spans of 15 feet. Both the bridges are of reinforced concrete construction on reinforced concrete piling of from 25 feet to 30 feet in length.

The second project from Midway Corners east involves the crossing of two creeks, namely, Sweeney Creek located approximately 1,000 feet easterly of the Midway Corners, and McCune Creek located approximately 1.6 miles east of Sweeney Creek. The twin bridges across Sweeney Creek are at right angles and consist of a 30-foot central span and two end spans of 22.5 feet with an over-all length of each bridge of 77.5 feet. The twin bridges across McCune Creek each involve a 48-degree skew and a total length of 108.35 feet consisting of two central spans of 30 feet with two end spans at 22.5 feet. As with the previous contract these bridges are of reinforced concrete on reinforced concrete piles approximately 28 feet in length.

RIGHT OF WAY PROBLEMS

The right of way problems on these two projects were quite different. The first project involved the acquisition of a total of 56 parcels of rights of way, 30 of which were required in the additional width required for the two new lanes of highway and 26 of which were required for additional widening to provide a uniform section, and for access rights along the existing highway. With the exception of about one-half mile of access rights at the westerly end of this project on the southerly side of the highway which had been acquired under a previous contract for constructing the highway through Vacaville it was necessary to acquire all of the access rights on both sides of this project.

In contrast to this, the right of way on the second project from Midway Corners to 1.3 miles north of Dixon involved very minor acquisition of access rights at a few county road intersections only. This section being on new location throughout, there was no existing road where full frontage usage had prevailed prior to the construction of this project. On the other hand the 160-foot width of right of way of this project did involve very complicated severance problems on relatively large holdings of property. There were but 20 parcels of right of way on this project but the acquisition required the complete study and analysis of the in-



Vibrator spreader attached to tamping and kneading machine. Operator is backing up header where key is attached

fluence of the new highway on the complete farming operations of each of these properties involved.

BIG TRAFFIC INCREASE

The traffic on U. S. Highway 40 per the monthly counts at given stations throughout the district increased 136.5 per cent in June of 1946 as compared to June of 1945 which was prior to V-J Day. Prior to the war, 1941 traffic represented the peak on this route. The traffic in June of the respective years showed a steady decline to 1945 at which time the traffic was approximately 57.5 per cent of the 1941 peak. In contrast the June traffic of 1946 is 35 per cent above the 1941 prewar peak. It is believed that this is a condition generally prevalent throughout the State on our entire highway system but a check of all the district stations compared to our 1945 June counts indicates an average of a 70 per cent increase as compared to the 136.5 per cent of this particular route.

The first project effects no saving in distance, but the second will involve a saving over the existing route of one and one-third miles for over 10,000 vehicles per 16-hour day at the present time. The basis of design is 2,500 vehicles per hour for mixed truck and automobile traffic for speeds of 60 miles per hour. This traffic peak should be reached by the year 1970.

PRESENT HIGHWAY INADEQUATE

The present two-lane road has been carrying traffic far in excess of its capacity for many years prior to the war. While total traffic during the war dropped off the volume of heavy truck traffic increased steadily. It now represents approximately 20 per cent of the total volume of traffic. It is rather amazing that speed checks taken on the two-lane highway in 1941 at two places within the limits of these sections showed average speeds of over 46 miles per hour.

The economic evaluation of time is difficult of exact analysis. Heavy dump trucks have operated rental rates in excess of 6 cents per minute. The minimum labor rate is in excess of 1½ cents, the average in excess of 2 cents per minute. Overtime labor rates are from 1½ to 2 times these figures, but it is doubtful if the average person off the job, particularly if on recreation places any value on his or her time. If we evaluate the time of the driver only and each vehicle, it is believed a value of 1½ cents per minute for all vehicles using this route can be substantiated.

ANNUAL SAVING HIGH

The total cost of the first project including preliminary and construction engineering, right of way and construction will approximate $725,000.

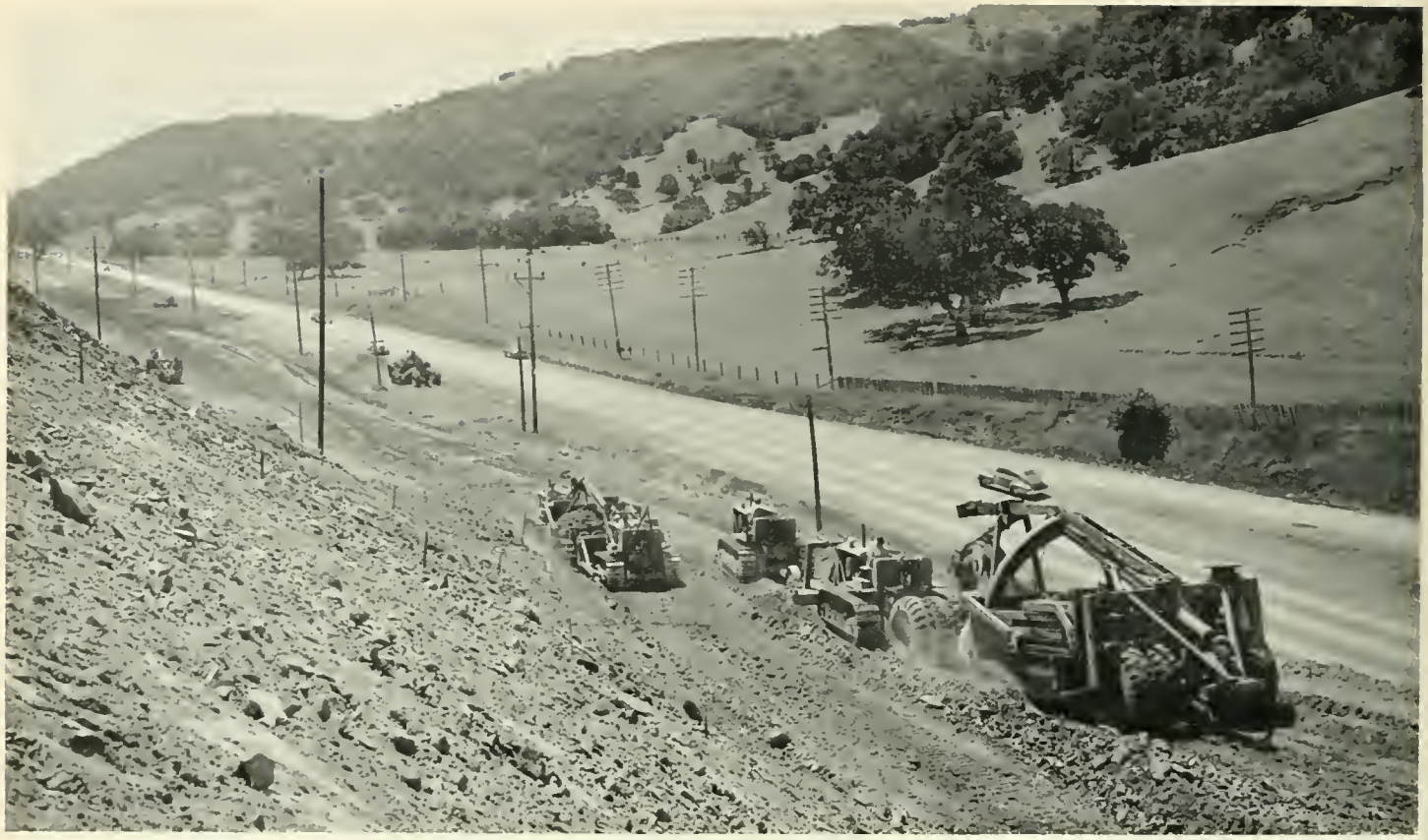
(Continued on page 25)



Cut widening at the south end of the project near Vacaville

Construction crew is placing headers while traffic is using the existing road





Tractor and carryall combination excavating cut. This view is looking south

NEW REDWOOD HIGHWAY PROJECT

By R. P. DUFFY, District Construction Engineer

THE Redwood Highway (U. S. 101) serving the Northern California coast counties is being converted into a four-lane limited access freeway between Ignacio and Petaluma in Marin and Sonoma counties for a distance of 11.8 miles.

The present road between these points consists of a two-lane 20-foot Portland cement concrete pavement on a 38-foot roadbed.

Studies for the expansion of this highway developed that the new line should be laid to cause the least interference with the heavy traffic using the present road during construction as well as to cause the least property damage and to most economically traverse the topography of the country within the limits of the project.

To accomplish this, a portion of the new construction lies to the west of the present road and a portion lies on the easterly side thereof.

Additional right of way width was necessary for this purpose and in such acquisitions, only limited access to the roadway was permitted in the deed transferring the property to the State, thereby reducing the points of access to the roadway from adjacent properties to a minimum.

Through the town of Novato considerable movement of business and residential buildings was necessary to clear the right of way for the improvement. Elsewhere along the route, occasional moves of farm buildings or roadside establishments were necessary while the facilities of the public utilities required relocation throughout most of the length of the project.

A portion of the work crosses some of the marshland areas of northern Marin County where soft foundations are encountered. In these areas provision has been made for placing overloads of earth on the roadway embankments to accelerate settlement, such overloads being left in place until the project is ready for paving. The overloads which are from two to five feet above profile grade are then removed and the material therefrom used to flatten the embankment slopes.

The new roadway will be paved with Portland cement concrete 23 feet in width and will be separated from the existing roadway by a 39-foot division strip over the major portion of the project.

Improved shoulders of crusher run base and armor coat surfacing three feet wide will be constructed adjacent to both sides of old pavement.

Crossovers between the two roadways are to be located at strategic points along the route as well as at the principal street crossings in the town of Novato which is bisected by the highway.



Woolridge Terra-Cobra scrapers excavating cut. The relation of the present road to the new construction is shown

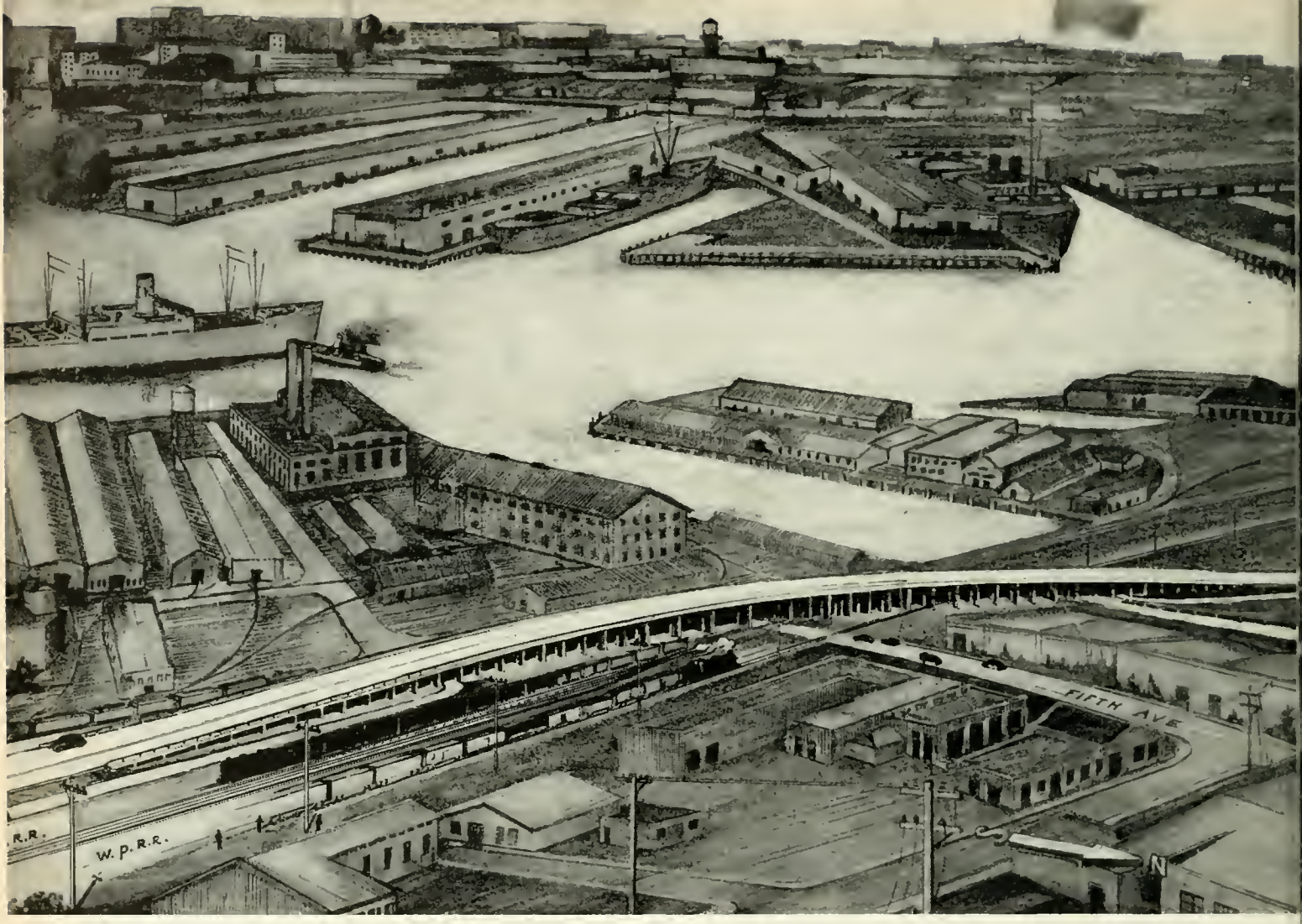
The construction of two reinforced concrete bridges, one over Novato Creek in Marin County and one over San Antonio Creek at the Marin-Sonoma County Line are included in the contract.

Base reinforcing to be placed under the concrete pavement is being produced locally on the job from material

(Continued on page 28)

Link Belt power shovel and trucks excavating rocky material from cut. This view is looking north





Engineer's sketch of Fifth Avenue Overhead, initial unit of the East Shore Freeway in Oakland, now under construction. The overh
tracks of the Western Pacific Railroad, the tracks of the Southern Pacific Company, and finally Fifth Avenue. After an easy desce

Fifth Avenue Overhead on

By JASON PLOW

PROGRESS has been resumed on the extension of the East Shore Freeway southeasterly through the City of Oakland in Alameda County. The section upon which construction has started will extend from Oak Street, between Fifth and Sixth Streets, to 0.3 mile south of High Street, near Alameda Avenue, a distance of 3.7 miles.

The Fifth Avenue Overhead is the initial unit in this section of the East Shore Freeway. A contract was awarded June 21st for the construction of a six-lane overhead structure 2554 feet in length together with appurtenant tracks and roads at an estimated cost of $1,692,897. The overhead structure will start about 0.2 mile east of Oak Street. Going easterly on a gradually rising grade, it will cross over in succession, the Lake Merritt Canal, the tracks of the Western Pacific Railroad, the tracks of the Southern Pacific Company and, finally, Fifth Avenue. After an easy descent the overhead will reach street level at a point between the Southern Pacific tracks and Oakland Inner Harbor opposite Eighth Avenue.

DESCRIPTION OF ROUTE

State Highway Route 69, known as the East Shore Freeway, when completed, will connect Richmond on the north with San Jose on the south. A major portion of the route will be a modern, limited access, divided highway. On the section from Oak Street to High Street there will be three large, overhead structures across railroad tracks and streets. In addition there are planned three structures carrying important city streets over the freeway.

There will be no crossing of freeway or railroad traffic at the same level, and pedestrians will not be permitted on the highway. The result will be that a large volume of traffic will flow over the route with speed and safety. It is estimated that in excess of 45,000 vehicles per day will use this first section, even though it is only a portion of a much larger project. Its true poten-



re starts 0.2 mile east of Oak Street, going easterly on a gradually rising grade, crosses over in succession the Lake Merritt Canal, the head will reach street level at a point between the Southern Pacific tracks and the Oakland inner harbor opposite Eighth Avenue

st Shore Freeway is Started

ociate Bridge Engineer

tialities will not be realized until more of the route is completed.

Traffic using the freeway will have been drawn from other existing routes, which in turn will assist in relieving the traffic congestion on these routes. Provision is being made to care for local as well as through traffic in the over all planning of the project.

A portion of the route from Richmond to the approach of the San Francisco-Oakland Bay Bridge is now in use. It will be extended south from Oakland as succeeding contracts are awarded for its construction.

DIMENSIONS OF STRUCTURE

In its almost half-mile of length, the Fifth Avenue Overhead will carry six traffic lanes, three in each direction, to a clear height of 22 feet 6 inches over four main line railroad tracks and three streets. Two 38-foot roadways with a 4-foot central division strip and 1-foot 9-inch safety curbs are to be built. Provision is made for the construction of additional lanes on the outside of the present lanes at such time as increased traffic demands. Change in horizontal alignment is made by a 2,000-foot radius curve, and a 1,550-foot vertical curve carries the structure gracefully over its highest points.

DESIGN FEATURES

Two factors, in general, governed the selection of type of structure to be used. The first was the type of foundation material found over the entire site, consisting of nominal depths of fill overlying many feet of unstable mud. This made piling necessary to reach stable material and support the footings. An economical structure in this case is the lightest structure consistent with structural requirements.

The second factor considered was the numerous spans over railroad tracks. A type requiring no falsework will offer the least hindrance to railroad traffic. In addition, a minimum depth of supporting girders is an

(Continued on page 31)

Garcès Circle - Memorial to a Pathfinder

By H. F. BRIGGS, Assistant District Office Engineer

PROBABLY few of the thousands of motorists traveling through Bakersfield, Kern County, and gazing for the first time at the 25-foot statue located in the center of the traffic circle on U. S. Highway 99 at its intersection with Chester Avenue, realize that the limestone figure perpetuates the memory of the friar reputed to be the first white man to visit the site of the present City of Bakersfield.

His name was Fray Francisco Hermenegildo Garcès. The traffic circle constructed by the Division of Highways in 1933 has been dedicated to him and is known as Garcès Circle. The imposing image of the Franciscan missionary priest is the culmination of the efforts of the Native Sons and Daughters of the Golden West, the Knights of Columbus, the Kern County Historical Society and others to honor and perpetuate his memory. The sculptor was John Palo-Kangas, a southern California artist.

The statue was dedicated on May 7, 1939, the anniversary of Garcès' first crossing of what is now known as Kern River. This crossing took place 170 years ago, at a time when another band of pioneers was struggling on the Atlantic Seaboard, to found a new Nation.

RECORD OF PADRE'S TRAVELS

Fr. Garcès left the record of his missionary travels in the form of diaries which reveal the enthusiasm of the explorer along with the crusading zeal of the missionary. He records the incredible 2,000-mile journey from New Mexico to the Southern San Joaquin Valley. The trip was made on foot and except for an Indian companion and a pack mule, was a solitary pilgrimage.

Garcès was a contemporary of the better known Junipero Serra, founder of California's chain of Franciscan Missions, one being educated at the missionary college at San Fernando at Mexico City, the other at a sister college of Santa Cruz at Querètaro. Garcès was a member of the St. Xavier Mission in Sonora, Mexico. He was associated with Juan Batista da Anza, who founded the first Spanish settlement in San Francisco. He did not, however, participate in the latter work, having separated from the main expedition at Yuma.



Statue of Frey Francisco Hermenegildo Garcès

Convinced that Monterey and the city now known as San Francisco could be more easily reached than by the exhausting trip along the coast, he set out to find the route. Unfortunately he failed to reach the easy outlet from the valley to the coast via Pacheco Pass. The White River in southern Tulare County marked the northernmost extent of his California travels.

SEASONED EXPLORER

Garcès was a seasoned explorer, having made long trips of discovery in the region adjoining the Colorado River. He was also one of the first white men to reach San Gabriel overland from missions farther south.

Accompanying Father Garcès on his trips into the south San Joaquin Valley was a Mojave Indian by the name of Sebastián Tarabal, known as "El peregrino" because of his extensive travels. Originally from Baja California, Tarabal had been taken to Mission San Gabriel from which he had run away, crossed the Colorado Desert and reached Altar in Sonora, Mexico.

Leaving San Gabriel on April 9, 1776, Garcès, Tarabal and several Indian guides proceeded to San Fernando. The following year, a mission was established at this location. From here the party crossed Newhall Pass to the region of Castaic where a delay was incurred due to illness of one of the Indians. Father Garcès used the wait as an opportunity to carry on missionary work among the neighboring rancherias. The conversion to Christianity of one of the Indian Chiefs resulted.

ENTERS SAN JOAQUIN VALLEY

The exact point at which Garcès entered the San Joaquin Valley is uncertain as the record in Garcès diaries is not entirely clear on this point. He called the mountains now known as the Tehachapi, the Sierra re San Marcos and evidently journeyed northward toward this chain. It is believed that he descended into the valley via Cottonwood and Tejon Creeks visiting an Indian Villiage in the vicinity of what later became the Tejon Ranch. Garcès referred to it as the Rancheria de San Pasquale and used it as a sort of headquarters for his operations. The Indians were of a tribe now identified as the Kitanemuk and at first feared the white man, which is considered evidence that they had had unfortunate previous contact with other white men, presumably Spanish soldiers.

Father Garcès soon won their confidence and greatly impressed them with his missionary hymns, prayers and reciting of the Rosary. He found during the rest of his journey that his fame had preceded him. His later dark skinned hosts clamored for songs and prayers and even attempted to bargain with him for his crucifix, believing it to have magic powers.

Anxious to pursue his quest for a new route to Monterey he urged his



Traffic circle on U. S. Highway 99 at its intersection with Chester Avenue in Bakersfield. Statue of Father Garcès in center of circle

Indian guides to continue with him. However, his recent hosts warned that Indian tribes to the north, now identified as the Yokuts, were unfriendly. Tarabal and the Mojaves refused to go on. Finally an old Yokuts tribesman who had married a Kitanemuk woman, volunteered to act as guide. The journey was resumed on April 27. The first contact with the supposedly unfriendly Indians proved their evil reputation to be unfounded.

Garcès reached the Kern River near the mouth of the canyon, some 14 miles northeast of Bakersfield. Greatly pleased with its clear waters he christened it "Rio de San Felipe." It is of interest to know that Kern River has had two other names. One of Indian derivation was Posuneola, the other was a local designation known as Rio Bravo. The modern name, as is well known, honors Edward M. Kern, the topographer who accompanied John C. Fremont on his second California expedition in 1845.

WELCOMED BY INDIANS

Dissuaded by his guide from attempting to cross the river, now swollen and turbulent, Garcès journeyed downstream to a rancheria where he was welcomed by the Indians and found that it afforded a safe place to cross. He tried to persuade the Indians to make a raft but was unable to convey this idea effectively. Finally after much argument as to the amount of clothing to be worn, the priest was carried across, clad only in his undergarments, by four Indians. His diary records his enjoyment of his bath in the river.

Pressing on along the foot hills on the east fringe of the valley he reached another river which he named the Rio de Santiago. This was probably Poso Creek. Here he found another rancheria. His old guide, unable to continue over the steep hills, left him. Securing another, Garcès continued to an Indian village in the vicinity of Woody. His diary states that the Indians at this village were bearded. The next day's march brought him to the vicinity of the present southerly boundary of Tulare County and White River, which he called Rio de la Santa Cruz.

FIRST CHRISTIAN BURIAL

Temporarily resting at a rancheria of some 150 Indians, Garcès received visitors from neighboring rancherias and carried on the work of his priestly offices. He administered the sacrament to a dying little Indian boy and gave a piece of cloth of gold from his meager supply of bargaining gifts for the child's shroud. This was undoubtedly the first Christian burial in the south San Joaquin Valley.

Garcès by this time had exhausted his store of presents and was compelled to turn back as the Indians refused to provide him with a guide. They thought by this means they could perspade him to remain with them. The ruse failed and when he boldly set out again on his way south, guides hastily followed him. They accompanied him to the vicinity of Poso Creek. This time he crossed the creek farther up in the hills and his guides, fearing bears which they claimed were there, left him. Garcès traveled all night through the rugged and lonely hills.

The priest reached Kern River farther upstream than he had been before and followed the river downstream to the rancheria he had first visited. The Indians directed him to a point still further downstream where he learned he could cross dryshod. The friar's diaries furnish a description of this spot which unmistakably indicates it to be the present site of Bakersfield. He mentions a commanding bluff later to be known as Kern Mesa. This area is now reached by a winding drive called the China Grade, from the early day Chinese vegetable gardens at its foot. It is rapidly developing into a fine residence district.

INDIANS CELEBRATE RETURN

The river divided into two forks forming what was once known as Kern Island, south of Bakersfield. This island is so designated on old Kern County maps. At the river fork Garcès found a large Indian Village

(Continued on page 32)

Highways Under Construction in District VIII Total $3,500,000

By CLYDE V. KANE, Senior Highway Engineer

UNDER the Postwar Highway Construction Program, District VIII has highways under construction in San Bernardino and Riverside Counties on three State highway routes. This work is being done under five separate contracts at a total cost of $3,500,000.

HIGHWAY 99, ONTARIO-TO-COLTON

The Ontario-to-Colton freeway is for the most part being constructed on new rights of way parallel to and separate from the existing highway. An economic study of loss of investment versus cost of access rights dictated the necessity for the new location in lieu of expanding existing facilities. It was found less costly to build on a new location rather than acquire numerous established access rights, move back the wayside improvements, and widen the existing pavement.

It has been possible to close some of the cross streets. A grade separation is being constructed on one, and rights of way sufficient for future separation structures and ramp facilities have been acquired on the remainder.



Cedar Avenue separation structure across the Ontario-to-Colton Freeway under construction

Design provides for four 12-foot concrete lanes with bituminous surfaced shoulders and an 86-foot dividing strip. Future expansion can be accomplished by constructing two lanes in the center.

A feature of the project is a requirement in the specifications providing that three inches of the subgrade immediately below the pavement be bituminous treated. Saturated subgrade material is commonly forced out at the pavement joints by the rocking action of the pavement slabs functioning as a diaphragm pump activated by moving traffic loads. The more material that is lost at the joints the more vigorous the pumping action becomes, which contributes to an accumulative pavement deterioration. The subgrade treatment is intended to prevent "loss of material" at the joints, thereby eliminating the deterioration of the smooth-riding qualities of concrete pavement. The contractor has elected to pre-mix this material in a continuous-mixer type of asphalt plant after crushing all material to minus three-quarters inch. The cost of the crushing and pre-mixing, in lieu of the cheaper road-mixing of pit-run material, was

Concrete paving on bituminous treated subgrade on the Ontario-to-Colton Freeway





Redlands project showing old road on right and grading for new 4-lane highway construction on left

absorbed by him to avoid the difficult factors involved in preparing an accurate subgrade using road-mixed material.

The section from Ontario to Etiwanda Avenue, a distance of 5.7 miles, is under contract to Matich Brothers at a cost of $478,000. The Resident Engineer is J. M. Cowgill.

Between Mulberry Street and Colton, a distance of 9.8 miles, the work is being done by the Griffith Company under a $1,387,000 contract. The Resident Engineer is Berndt Nelson.

Between Etiwanda Avenue and Mulberry Street, a distance of one mile, the work is being deferred pending negotiations with the Southern Pacific Railroad Company. In this section, a railroad separation structure and a structure providing separation of distributing traffic lanes connecting to the old highway are to be constructed. The estimated cost of the section is $600,000.

This hazardous curve at the bottom of a long, steep grade in Redlands is eliminated





Drilling rock prior to excavating roadway cut near Mira Loma

HIGHWAY 99 IN THE CITY OF REDLANDS

The Redlands highway work extends from State Street near the center of the city to the east city limits. The construction expands the modern existing two-lane highway but deviates from the route of an old city street now being used, by a change avoiding two sharp curves that could not be flattened.

Access rights have been acquired throughout except for the portion being constructed on an existing city street of three blocks. The plans provide for four lanes of concrete pavement with bituminous shoulders and a dividing strip.

This project covering a distance of 2.8 miles is under contract to Matich Brothers at a cost of $310,000. J. M. Hollister is Resident Engineer.

HIGHWAY 60, POMONA-TO-RIVERSIDE

Work is being continued on the Pomona-to-Riverside highway planned with four-lane divided construction having limited access rights of way acquired along existing and new location.

The portion at present under construction between Mira Loma and a point 2½ miles west of Riverside will have bituminous plant-mix surfacing placed on a cement-treated subgrade. Disintegrated granite material of an excellent quality for this subgrade is being produced from within the roadway excavation prisms.

The work, covering a distance of 5.9 miles, is under contract with George Herz, Contractor, at a cost of $633,000. E. A. Bannister is Resident Engineer.

CITY CREEK ROAD

The City Creek Road to provide an alternate route for the rapidly increasing recreational traffic to the San Bernardino mountains is to be constructed in several units. The first unit, from Highland Avenue near Patton to the City Creek Bridge, is now being constructed on new rights of way acquired with limited access.

This project, providing for two-lane bituminous surfacing on a 26-foot roadbed with 300-foot minimum radius curves, is considered an exceptionally high standard recreational road for the precipitous terrain traversed. Roadway excavation for the 3.2 miles distance will require moving 486,000 cu. yds. of rock and cemented material. In addition, some slide removal is anticipated.

The contract provides for the construction of numerous concrete and new design metal bin-type retaining walls. Also provided is a 430-foot reinforced concrete arch bridge. The high embankment slopes will be protected from erosion by the incorporation of brush mats in the outer five feet and the ample provisions for planting and seeding.

The work is under contract to the Denni Investment Corporation at a cost of $652,000. Wayne Crawford is Resident Engineer.

Illegal Tree Cutting Brings Stiff Penalty

IT doesn't pay to cut down trees on State highway rights of way without permission, as Fil Gianatti, owner of Connelley's Inn at Bijou, Lake Tahoe, will attest.

The Division of Highways has received a check for $1,500 from Gianatti in settlement of a suit for damages brought by the division after Gianatti had ordered the cutting down of 56 tamarack and 85 pine trees which lined the highway in front of Connelley's Bijou Inn.

According to State Highway Engineer George T. McCoy, Gianatti requested permission to remove the trees, was refused, and on November 7th last instructed his manager, H. R. Pace, to cut them down. McCoy said that the destroyed trees will be replaced with new plantings at a cost of $4 per tree which will be paid for out of the check received today from Gianatti.

"Protection of trees within State highway rights of way is vested in the Department of Public Works by law," McCoy said. "It is the policy of the Division of Highways to protect for beautification purposes trees and shrubbery either of natural growth or by planting by the division and in accordance with this policy Mr. Gianatti was refused a permit to destroy the trees involved in the suit which was instituted by the Legal Division of the Department of Public Works. We hope the penalty assessed against Mr. Gianatti will deter others from illegal cutting or defacing of trees growing on State-owned highway property."

Bobby—"Pop, what is woman's intuition?"
Father—"Son, I think it's about three-fourths suspicion."

BUS SERVICE SWEDEN-SWITZERLAND

According to reports from Stockholm, regular bus service between Sweden and Switzerland has been inaugurated. Two and one-half days are required for the one-way trip.

Work of Division of Highways

(Continued from page 1)

on the southerly portion of the improvement.

Development of the Balboa Park Freeway in the City of San Diego on the inland route to Riverside, progressed through the award of seven contracts, six of which provided for nine grade separation and bridge structures and one for roadway grading and paving. Two additional contracts for highway grade separations are now pending award.

A start also was made in developing the northerly end of the Santa Ana Parkway in Los Angeles through the letting of six contracts including four major grade separations.

One of the larger single contracts awarded, provides for the construction of a million and a half dollar bridge across the Feather River between Marysville and Yuba City on U. S. 99 E. Construction of this bridge and its approaches in the two cities was planned for 1942, but the improvement was deferred by wartime restrictions.

Another important development in the Sacramento Valley is the construction of the North Sacramento Freeway on U. S. 40. This project connects with the viaduct at the north end of the Sixteenth Street Bridge which was completed early in the war years and will provide a modern freeway approach to Sacramento from the east and north.

The rerouting of U. S. 40 in the city of Auburn in Placer County, including three major grade separations, also is under construction and further improvement to U. S. 40 is under way by two large contracts located between Vacaville and a mile north of Dixon. This latter construction continues the four-lane divided standards begun before the war from the Yolo Causeway to Dixon on the route between the San Francisco Bay area and Sacramento.

Development to four-lane arterial standards on sections of U. S. 99 in San Bernardino County, between Colton and Redlands and on U. S. 60 west of Riverside in Riverside County were also features of the department's construction activities for the year.

In Marin and Sonoma Counties, that section of the Redwood Highway between Ignacio and Petaluma is being developed to modern divided arterial standards, as are sections of U. S. 101 in Monterey County, in the vicinity of Salinas and in Santa Barbara County northerly of the City of Santa Barbara.

Similar divided arterial development is under way to several sections of the Valley Route (U. S. 99) in Kern, Fresno, Merced and San Joaquin Counties.

While not a part of the State's postwar program, nevertheless an appreciable portion of the Division's current construction activity is the building for the U. S. Navy of the $6,000,000 Federal Access approach to Terminal Island at Long Beach in Los Angeles County.

The work of the Division on the State Highway System during the first postwar year marks an excellent start on the rehabilitation of the State's highways. The program, and it is a large one, has, however, only scratched the surface in meeting the needs of traffic. If these needs are to be met, construction and reconstruction must be continued on similar State-wide scales in the years ahead. To accomplish this end, adequate provision must be made for the ample financing of such future programs.

For many months prior to the end of the war, Division of Highways engineers bent every effort possible, in the face of the heavy wartime access construction for Federal agencies, toward preparation of plans and specifications for projects included in the postwar program.

This preparation made possible immediate action as soon as Federal approval was received for the first postwar year's program. The approval by the Public Roads Administration was received on October 29, 1945, and the Division of Highways issued the first calls for bids on projects included in the program on November 9, 1945.

Between that date and June 30, 1946, bids for highway construction and repair were opened on 170 projects which, including construction items, right of way and construction engineering, amounted to a value of approximately $53,000,000. By June 30, 1946, 153 contracts with a value of $50,000,000 had been awarded by the department.

While this progress in placing the postwar highway program under construction covered only seven months, it accounts for nearly 80 per cent of the contracts awarded during the entire fiscal year.

Message from Madrid

THE FOREIGN SERVICE
OF THE
UNITED STATES OF AMERICA

American Embassy,
Madrid, Spain,
June 11, 1946

Mr. Kenneth C. Adams, Editor,
California Highways and
Public Works,
Sacramento, California

Dear Mr. Adams: It was very kind of you to send the California Missions series of your magazine. I have been away from California since 1941 and I assure you it was like a breath of heaven to me to see all those beautiful photographs, not only of the Missions but of the highways and the beloved familiar landscapes.

Your Mission articles are splendid and the up-to-date pictures were of great interest here. We had a series of slides made, copying several of your photographs. I gave three lectures in Spanish and one in English, showing the illustrations each time. While I hated to part with the magazines, I have given them to the permanent collection of the Casa Americana Library. This institution is an adjunct of the American Embassy in Madrid, open to free use by Spaniards who are studying English or wish information about the United States.

There is great interest here in American engineering methods. If it would be feasible for you to send the magazine regularly to the Casa Americana it could be circulated from there to the libraries of the University and the Engineering School.

Again thanking you,
Very sincerely,
Marion Parks

"Darling Daisy," wrote Clem to his beloved, "I would swim the mighty ocean for one glance from your dear eyes. I would walk through a wall of flame for one touch of your little hands. I would leap the widest stream for one word from your lovely lips. As Always, your Clem."

"P. S.—"I'll be over Saturday night if it doesn't rain."

"Say, do you realize you have your wedding ring on the wrong finger?"

"Yes. I married the wrong man."

California Construction Program For Second Postwar Year Approved

G. H. PURCELL, Director of Public Works, and Chairman of the California Highway Commission, informed the commission at its meeting on July 18th that he had been notified by G. T. McCoy, State Highway Engineer, that the $46,000,000 State highway construction program for the second postwar year was approved in Washington by Thos. H. MacDonald, U. S. Commissioner of Public Roads on July 15, 1946.

This construction program, adopted by the Highway Commission, is designed to continue the postwar rehabilitation and development of the California State Highway System which was begun last November under the program for the first postwar year which was adopted by the commission on September 24, 1945.

Projects included in the program involve work located in 35 of the 58 counties and provides for all types of construction including grading, surfacing, paving on nearly 240 miles of State highway and the construction of some 30 major bridges. The program also provides for numerous grade separation structures as units of proposed metropolitan area freeways.

As practically all of the projects included in the program for the first postwar year are under way, the Division of Highways expects to start advertising for bids on the projects of the second year program immediately.

Since November of last year, contracts have been awarded for State highway construction projects amounting in cost to approximately $50,000,000.

The projects for the second postwar year are listed in the following table:

County	*Route	Description	Miles
Alameda	SR 17	6th and Oak Streets to High Street in Oakland (portions), grade, pave and structures	3.3
El Dorado, Placer	SR 49	North Fork American River, bridge and approaches	0.2
Fresno	US 99	¼ mile south of Fowler to Calwa Overhead, grade and pave	7.3
Fresno	SR 41	Shields Avenue to Herndon Avenue, grade, pave and structures	4.0
Humboldt	SR 96	Klamath River at Weitchpec, bridge and approaches	0.6
Imperial	US 80	At New River, bridge and approaches	----
Imperial	US 99	El Centro to Brawley, grade, pave and structures	12.9
Imperial	US 99	At San Felipe Wash, bridge and approaches	----
Inyo	US 6 US 395	Five Mile Canyon, grade, surface and structures	2.2
Kern	US 99	Bakersfield to Snow Road, grade, pave and structures	3.5
Kern	US 99	Cawelo to Famoso, grade, pave and structures	6.7
Kern	US 6	Ricardo to Freeman Station (portions), grade, surface and structures	1.6
Kern	US 6	Indian Wells Canyon, grade, surface and structures	2.2
Kern	US 466	Mojave to Muroc Junction, grade and surface	9.0
Kern	US 466	Keene to Tehachapi, grade, surface and structures	10.2
Kern	US 466	Three overflow bridges between Buttonwillow and Enos Lane, replace with culverts and fills	----
Kern, Tulare	SR 65	Route 4 to Ducor, grade, surface and structures	23.4
Lake	SR 29	Kelsey Creek at Cobb, bridge and approaches	----
Los Angeles	US 101	Aliso Street to Vermont Avenue (portions), grade, pave and structures	4.1
Los Angeles	US 101	Vermont Avenue to Highland Avenue (portions), grade, pave and structures	4.2
Los Angeles	US 101	Barham Overpass to Vineland Avenue, grade, pave and structures	1.6
Los Angeles	19	Route 77 to Pomona, grade and pave	0.7
Los Angeles	Alt US 101	Latigo Creek Canyon to Malibu Creek, grade, pave and structures	4.2
Los Angeles	SR 2	Angeles Crest Highway, grade and surface	---
Los Angeles	US 6	Adobe Street to Fifth Street (portions), grade, pave and structures	1.2
Marin	US 101	At Liaden Lane in San Rafael, grade separation and approaches	3.4
Mendocino	US 101	Red Mountain Creek to Piercy, grade, surface and structures	3.4
Mendocino	US 101	Northwestern Pacific Railroad to Underpass, grade and surface	0.8
Mendocino	SR 28	At Lost Creek and Red Bank Creek, bridges and approaches	---
Mendocino	SR 1	Mitchell and Hare Creeks and Noyo River, bridges and approaches	2.5
Modoc	US 395	South Fork of Pit River, bridge and approaches	0.1
Modoc	US 395	Junction with Route 28 to State Line (portions), grade and surface	---
Mono	111	Grant Lake to Route 23, grade and surface	2.6
Monterey, San Benito	US 101	0.8 mile north of Crazy Horse Summit to Chittenden Road, grade, surface and structures	6.7
Nevada	SR 49	1.5 miles north of Rattlesnake Creek to Grass Valley, grade and surface	3.8
Orange	US 101	Doheny Park to San Juan Creek, grade and pave	0.9
Orange	SR 18	Santa Ana Canyon Road, Peralta to Olive Cutoff, grade and surface	4.5
Orange	Alt US 101	Laguna Beach to Dana Point (portions), grade and pave	4.9
Placer	SR 49	Junction new Route 37 in Auburn to U.S. General Hospital, grade, surface and structures	3.5
Placer, El Dorado	SR 49	North Fork American River, bridge and approaches	0.2
Riverside, San Bernardino	US 60	0.8 mile east of Ontario to Mira Loma, grade, pave and structures	6.4
Riverside	SR 111	Whitewater Point to 0.5 mile north of Palm Springs, grade, surface and structures	5.5
Sacramento	SR 24	Three Mile Slough, bridge and approaches	---
San Benito, Monterey	US 101	0.8 mile north of Crazy Horse Summit to Chittenden Road, grade, surface and structures	6.7
San Bernardino, Riverside	US 60	0.8 mile east of Ontario to Mira Loma, grade, pave and structures	6.4
San Bernardino	SR 18	1.2 miles east of Victorville to Victorville, grade and surface	1.2
San Diego	SR 94	At Dulzura Creek, bridge and approaches	---
San Joaquin	US 99 US 50	Junction Mariposa Road south of Stockton to Calaveras River and Wilson Way to Route 4 (portions), grade, pave and structures	7.2
San Joaquin	US 50	San Joaquin River bridge at Mossdale	---
San Luis Obispo	US 101	San Luis Obispo to Cuesta Grade, grade and pave	2.7
San Luis Obispo	SR 41	Santa Rosa Creek, Black Mountain Creek, and Rocky Creek, bridges	---
San Mateo	Bay Shore Freeway	0.3 mile south of S.P. Underpass to Broadway in Burlingame, grade, pave and structures	4.6
Santa Barbara	US 101	Sheffield Drive to San Ysidro Road, grade, pave and structures	1.3
Santa Barbara	US 101	Las Varas Creek to one mile east of El Capitan Creek, grade, pave and structures	2.9
Santa Clara	SR 17	Bascom Avenue to Park Avenue, grade and pave	1.3
Shasta	US 99	South County Boundary to Clear Creek, surface and structures	10.7
Shasta	US 299	Shasta to Schilling, grade, surface and structures	4.6
Shasta	US 299	Sacramento River at Redding, bridge and approaches	1.3
Siskiyou	US 99	Camp Lowe to Bailey Hill, grade separation and bridge	---
Solano	90	Route 7 to 0.5 mile north of Sweeny Creek, grade, pave and structures	5.7
Trinity	US 299	East Weaver Creek, bridge and approaches	---
Tulare, Kern	SR 65	Route 4 to Ducor, grade, surface and structures	23.4
Tulare	132	Packwood Creek to Route 10, grade and surface	2.3
Tuolumne	SR 108	Stockton Street entrance to Sonora, Solinskey Street to Washington Street, grade, surface and structures	0.4
Ventura	US 101	Ventura Avenue to S.P. Overpass, grade and pave	1.0
Ventura	US 101	El Rio to Ventura, grade and pave	6.0

** Unless designated as a U. S. Route or State Sign Route, route number is a State Route.*

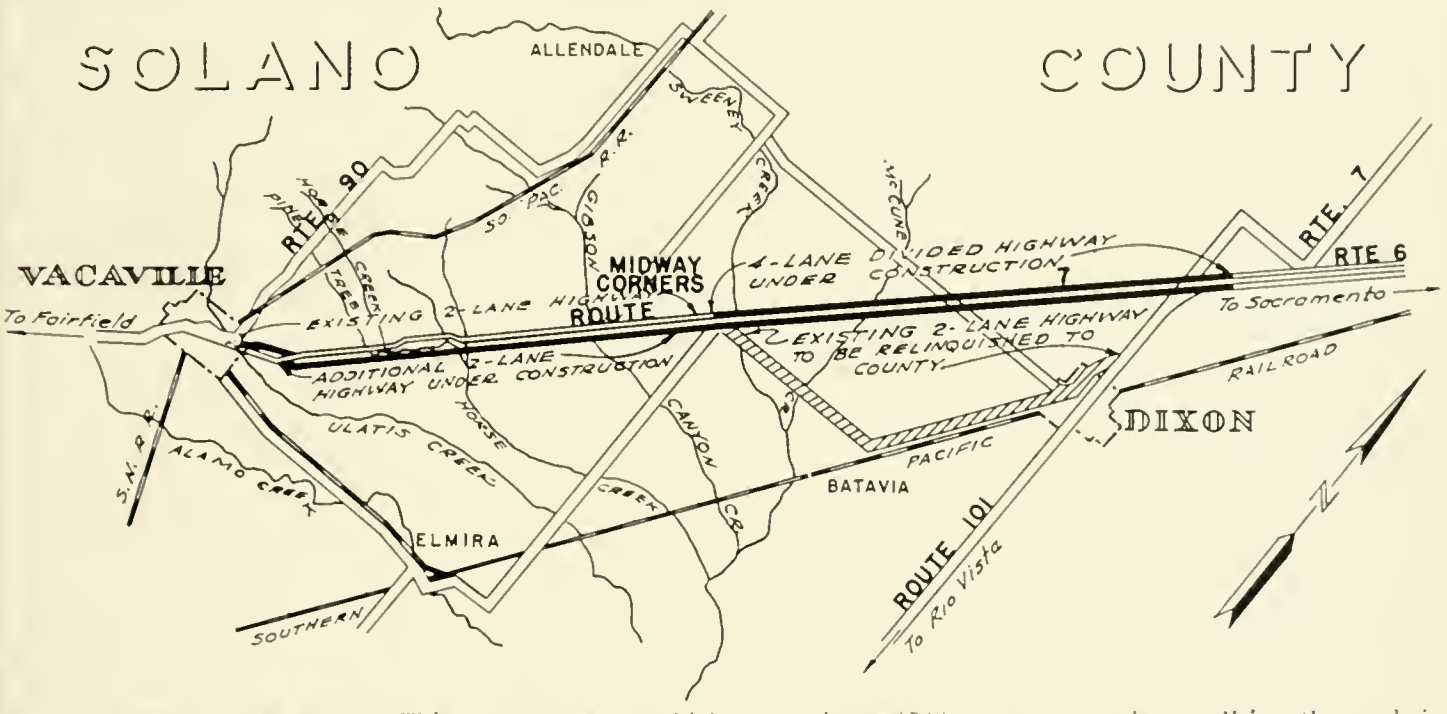
Two Postwar Highway Projects on U.S. 40 in Solano County

(Continued from page 12)

It is estimated that at least 1.6 minutes driving time or 2.4 cents will be saved for 10,000 vehicles traversing this six-mile section at the present time. This represents $240 per day or $86,500 per year. The comparable annual saving in 1970 would be some $217,000, the total for this 24-year period $3,650,000. This project will more than pay for itself from the standpoint of time saving alone in seven years.

The total cost of the second project is approximately $2,000,000. This project has a savings in distance of 1¼ miles reflecting reduced vehicle operating costs in addition to more appreciable time savings than on the first project. Using the very low figure of 3 cents per vehicle mile, this project will save in vehicle operating costs $400 per day on present traffic or $146,000 annually. In 1970 this would amount to $1,000 per day or $365,000 annually. Comparable time savings are 3.6 minnes or 5.4 cents per vehicle amounting to $540 per day or $197,000 per year now. In 1970 this would amount to $1,350 per day or $493,000 annually. The combined vehicle operating and time saving costs would, therefore, be $940 per day or $343,000 per year on the basis of present traffic or $2,350 per day and $868,000 annually in 1970. This project will, therefore, reimburse the motorist who pays for it in a period of about five years in the combined distance and time saving effected.

The first project has a time limit of 310 weather-working days, the second project a time limit of 460 days. The contractor is expediting the work in every way possible and it is not unreasonable to expect that the traveling public may be enjoying the use of a major part of this 12-mile section of highway by the end of this year. When completed these projects, together with projects constructed previously, will provide a continuous four-lane highway from Sacramento to Vacaville.



Liability Insurance as Related to California Highway Contracts

(Continued from page 2)

In the postwar construction program now under way, it has frequently been found expedient to combine certain work in connection with grade crossing elimination projects with adjacent roadway construction. On these projects only a small portion of the work usually is on railroad property. However, because of the railroad hazard and in accordance with agreements between the State and the railroads, it is necessary to incorporate insurance requirements in the contracts.

In resume, liability insurance, in general, is specified in State highway construction contracts only to fulfill the State's obligations with another agency, usually a railroad. Insurance must be provided which will give a complete coverage for all risks, and full coverage must be provided throughout the life of the contract. Each subcontractor performing work that might endanger a railroad must also furnish direct insurance coverage. Each policy must certify that the State shall receive prior notice of cancellation or any reduction in coverage as discussed above. One certified copy of all insurance policies must be approved by the State's attorneys and be placed on file with the contract documents.

Highway Bids and Contract Awards for June and July, 1946

June, 1946

ALAMEDA COUNTY—Between Dublin and Mission San Jose and between Alvarado and San Leandro, about 7.6 miles to be repaired with crusher run base and plant-mixed surfacing. District IV, Routes 5, 69, Sections B,C,B. Hayward Building Material Co., Hayward, $159,276; Lee J. Immel, San Pablo, $179,362.40. Contract awarded to A. S. Jones, Napa, $158,786.

ALAMEDA COUNTY—On East Shore Freeway, in the city of Oakland, an overhead crossing over the tracks of the Southern Pacific and Western Pacific Railroads, at Fifth Avenue, to be constructed. District IV, Route 69, Chas. L. Harney, San Francisco, $1,747,-187.15; A. Soda & Son, Oakland, $1,793,-565.84; Clinton Construction Co., San Francisco, $1,892,611.88; Fredrickson & Watson Construction Co. and M & K Corp., Oakland, $1,945,468.44. Contract awarded to Stolte Inc. and The Duncanson-Harrelson Co., Oakland, $1,692,897.20.

ALAMEDA COUNTY—Across Alameda Creek and over the tracks of Western Pacific Railroad Co. about 2.7 miles west of Sunol, a bridge and overhead crossing and approaches to be constructed. District IV, Route 107, Section A. Dan Caputo & Edward Keeble, San Jose, $445,278.75; Chas. L. Harney, San Francisco, $468,608.50; A. Soda & Son, Oakland, $499,984.84; Fredrickson & Watson Construction Co., Oakland, $537,744.95; M & K Corporation, San Francisco, $548,371. Contract awarded to R. G. Clifford and Louis Biasotti & Son, Stockton, $427,966.

CALAVERAS COUNTY—In the city of Angels, across Angels Creek, a concrete bridge and approaches to be constructed. District X, Route 24, Transwestern Construction Co., Sacramento, $46,450.30; Contract awarded to J. Henry Harris, Berkeley, $40,410.83.

CONTRA COSTA COUNTY—Between Broadway Tunnel and Orinda Junction and between Walnut Creek and 3.5 miles easterly, about 5.3 miles, placing plant-mixed surfacing on existing plant-mixed tapers and applying seal coat thereto, constructing shoulders of imported borrow and C.R.B. and applying penetration treatment thereto. District IV, Route 75, Sections A,B. Lee J. Immel, San Pablo, $24,514; J. Henry Harris, Berkeley, $30,341.27; McGuire & Hester, Oakland, $34,065. Contract awarded to N. M. Ball Sons, Berkeley, $23,634.

DEL NORTE COUNTY—Between Second Crossing of Smith River and Idlewild, about 0.6 mile, roadbed to be repaired and sacked concrete riprap placed. District 1, Route 1, Sections C,E. W. C. Railing, Redwood City, $109,505. Contract awarded to John Burman and Sons, Eureka, $102,004.50.

KERN COUNTY—Between 8.7 miles and 2.0 miles west of Wasco, about 6.7 miles to be repaired with road-mixed surfacing and seal coat. District VI, Route 33, Section C. Clyde W. Wood, Inc., North Hollywood, $55,405; Oilfields Trucking Company & Phoenix Construction Co., Bakersfield, $59,550. Contract awarded to Griffith Co., Los Angeles, $53,629.

LASSEN COUNTY—Furnishing and stockpiling plant-mixed surfacing between Litchfield and Ravendale. District II, Route 73, Sections A,B,D. Contract awarded to E. B. Bishop, Orland, $7,200.

LASSEN COUNTY—Furnishing and stockpiling plant-mixed surfacing at Doyle Maintenance Yard and at Long Valley Maintenance Yard. District II, Route 29, Sections D,E. Contract awarded to Isbell Construction Co., Reno, $3,464.60.

LOS ANGELES AND ORANGE COUNTIES—At intersection of Rosemead Blvd. and Washington Blvd., and in Orange County at intersections of Coast Highway with Main Street and with Bay Blvd. in Seal Beach, traffic signal systems to be furnished and installed. District VII, Routes 168,60, Section B,SB. C. D. Draucker Co., Los Angeles, $25,352. Contract awarded to Econolite Corp., Los Angeles, $20,995.

MENDOCINO COUNTY—Between Burke Hill and one mile north, about one mile to be repaired with imported base material and plant-mixed surfacing. District 1, Route 1, Section B. Louis Biasotti & Son, Stockton, $37,593.50. Contract awarded to C. M. Syar, Vallejo, $33,764.

MERCED COUNTY—Between San Joaquin River and Madera County line, about 3.0 miles to be repaired with untreated rock base and plant-mixed surfacing. District X, Route 32, Section C. M. J. Ruddy & Son, Modesto, $85,673.50; Gunner Corp., Pasadena, $87,-663.50. Contract awarded to Frank B. Marks & Sons, Tracy, $82,421.70.

MERCED COUNTY—Between 3 and 4.3 miles northeast of Gustine, a bridge across Mud Slough and a culvert at Garzas Creek to be constructed. District X, Route 122, Section A. Erickson, Phillips & Weisberg, Oakland, $59,888; George M. Carr & Bati Rocca, Santa Rosa, $64,783. Contract awarded to Dan Caputo, San Jose, $51,731.

MONTEREY COUNTY—Between Del Monte Junction and Seaside Junction, about 3 miles to be graded and paved with Class B Portland cement concrete. District V, Routes 117, 56, Sections A,I. Granite Construction Co., Watsonville, $474,793.90; A. Teichert & Son, Inc., Sacramento, $475,344; Marshall S. Hanrahan, Redwood City, $562,260. Contract awarded to N. M. Ball Sons, Los Angeles, $470,026.50.

ORANGE COUNTY—Between 1.4 miles north of El Toro Road and south city limits of Tustin, a distance of about 8.3 miles, shoulders to be widened with bituminous surface treatment and a portion of the project to be resurfaced with plant-mixed surfacing. District VII, Route 2, Sections B,C. Sully-Miller Contracting Co., Long Beach, $92,770; Oswald Bros., Los Angeles, $94,040; Cox Bros. Construction Co., Stanton, $102,340; Jesse S. Smith, Glendale, $105,070; Griffith Co., Los Angeles, $105,465. Contract awarded to John J. Swigart Co., Torrance, $92,082.

ORANGE COUNTY—Between Verano Street and west city limits of Santa Ana, about 1.8 miles to be resurfaced with plant-mixed surfacing and shoulders to be widened with imported borrow and bituminous surface treatment applied thereto. District VII, Route 183, Section A. Cox Bros. Construction Co., Stanton, $29,795; Jesse S. Smith, Glendale, $29,875; Sully Miller Contracting Co., Long Beach, $30,285; Oswald Bros., Los Angeles, $30,760. Contract awarded to John J. Swigart Co., Torrance, $29,363.

PLACER COUNTY—Between 0.1 mile westerly of Nevada Street in Auburn and 1.0 mile northeasterly of the north city limits of Auburn, about 2.6 miles, to be graded and surfaced with Portland cement concrete pavement and plant-mixed surfacing. District III, Routes 17 & 37, Sections B, Aub.,A. N. M. Ball Sons and H. W. Ruby, Berkeley, $683,-676.25; Harms Bros., Sacramento, $749,175; Guy F. Atkinson Company, South San Francisco, $788,315; A. Teichert & Son, Inc., Sacramento, $816,619.30. Contract awarded to Fredrickson & Watson Construction Co., Oakland, $614,492.50.

PLACER, NEVADA AND YUBA COUNTIES—At various locations, seal coat to be applied on a net distance of about 35.2 miles. District III, Routes 3, 15, 37, 38. Folsom and Drollinger, Sacramento, $37,200.60. Contract awarded to J. Henry Harris, Berkeley, $35,181.35.

RIVERSIDE COUNTY—Between Midway and east city limits of Banning, about 3.1 miles, shoulders on a portion to be graded and the entire project to be repaired by placing plant-mixed surfacing over the existing pavement and shoulders and applying Class "C" medium seal coat. District VIII, Route 26, Section B,Ban. E. L. Yeager, Riverside, $56,190; Oswald Bros., Los Angeles, $56,-242.50. Contract awarded to Herz Paving Co., San Bernardino, $52,450.

SACRAMENTO AND YOLO COUNTIES—Between Sacramento city limits and 0.5 mile east and between 0.4 mile and 9.6 miles north of Solano County line, about 6.1 miles to be repaired with plant-mixed surfacing. District III, Routes 11, 99, Sections B,A. McGillivray Construction Co., Sacramento, $38,967.50; Folsom & Drollinger, Sacramento, $38,867; A. Teichert & Son, Inc., Sacramento, $39,291; E. A. Forde, San Anselmo, $41,075. Contract awarded to Harms Bros., Sacramento, $38,405.

SACRAMENTO COUNTY—Between the Antioch Bridge and Emmaton, about 3.4 miles, to be repaired with imported borrow and bituminous surface treatment. District X, Route 11, Section C. Milo A. Browne, Palo Alto, $45,530; J. Henry Harris, Berkeley, $49,045; Asta Construction Co., Rio Vista, $49,180; Combs Bros., San Leandro, $49,-992.50; E. A. Forde, San Anselmo, $53,305; Peter Sorensen, Redwood City, $55,555; Fredrickson & Watson Construction Co., Oakland, $61,500. Contract awarded to Sheldon Oil Company, Suisun, $39,990.

SANTA BARBARA COUNTY—At Hollister Wye between Santa Barbara and Goleta about 0.9 mile to be graded and surfaced with plant-mixed surfacing. District V, Route 2, Sections P,Q. Dimmit & Taylor, Los Angeles, $197,770; Haddock Company, Pasadena, $229,507.60. Contract awarded to Jesse S. Smith, Glendale, $152,165.50.

SAN BERNARDINO COUNTY—Across Mill Creek about 8 miles east of Redlands, a bridge and approaches to be constructed. District VIII, Route 190, Section D. Spencer Webb, Inglewood, $105,590. Contract awarded to Bent Construction Co., Los Angeles, $94,370.

SAN BERNARDINO COUNTY—At two locations: (1) about 1.5 miles west of Ontario, and (2) between about ¾ mile and 2.75 mile east of Upland, trees to be cleared. District VIII, Routes 26, 9, Sections C,A. Contract awarded to California Tree Service, Hollywood, $2,312.

SAN BENITO COUNTY—Between Prunedale Junction and the Santa Clara County line, about 1.6 miles to be repaired by cement treatment of existing base and surfacing, placing plant-mixed surfacing thereon and placing imported borrow on shoulders and applying bituminous surface treatment thereto. District V, Route 2, Section A. A. Teichert & Son, Inc., Sacramento, $65,626.50. Contract awarded to Granite Construction Company, Watsonville, $59,949.09.

SAN BERNARDINO COUNTY—Between Victorville and Oro Grande Underpass, about 4.7 miles to be repaired with plant-mixed surfacing. District VIII, Route 31, Section D. Contract awarded to George Herz & Co., San Bernardino, $38,367.

SAN BERNARDINO COUNTY—Between Squirrel Inn and Big Bear Dam, about 13.8 miles, to be repaired with road-mixed surfacing and seal coat. District VIII, Route 43, Sections B,C. Arthur A. Johnson, La-

guna Beach, $91,515; Clyde W. Wood, Inc., North Hollywood, $98,210; Warren Southwest, Inc., Los Angeles, $105,312; Herz Paving Co., San Bernardino, $116,732. Contract awarded to R. R. Hensler, Glendale, $79,500.

SAN BERNARDINO COUNTY—Between Alpine and Lake Arrowhead and between Lake Arrowhead Dam and Burnt Mill, 6.3 miles to be repaired with road mixed surfacing and seal coat. District VIII, Routes 189, 59, Sections A,E,F. Arthur A. Johnson, Laguna Beach, $38,330; Bonadiman McCain, Inc., Los Angeles, $45,999.20. Contract awarded to R. R. Hensler, Glendale, $34,600.

SAN DIEGO COUNTY—A reinforced concrete overcrossing over Balboa Parkway, at University Avenue, in San Diego, to be constructed. District XI, Route 77. Carroll & Foster, San Diego, $117,114. Contract awarded to M. H. Golden Construction Co., San Diego, $131,631.50.

SAN DIEGO COUNTY—At Route 77 and Mission Valley Road in San Diego, two reinforced concrete overcrossings to be constructed. District XI, Route 77. Carroll & Foster, San Diego, $276,086. Contract awarded to M. H. Golden Construction Co., San Diego, $263,453.75.

SAN DIEGO COUNTY—A steel girder overcrossing on Route 77 at Friar's Road, in San Diego, to be constructed. District XI, Route 77. Carroll & Foster, San Diego, $69,772; M. H. Golden Construction Co., San Diego, $70,559; Haddock Engr. Ltd., Oceanside, $96,985. Contract awarded to Fred D. Kyle, Pasadena, $63,936.

SAN JOAQUIN COUNTY—Between Calaveras River and Lodi, about 8.2 miles to be graded and paved with Portland cement concrete and three bridges to be constructed. District X, Route 1, Section C. N. M. Ball Sons and H. W. Ruby, Berkeley, $853,361; Bressi & Bevanda Constructors, Inc., Los Angeles, $870,895.05; A. Teichert & Son, Inc., Sacramento, $873,601.80; Clyde W. Wood, Inc., North Hollywood, $879,187.45; Marshall S. Hanrahan, Redwood City, $883,343.05; Fredrickson Bros., Emeryville, $1,051,202.30. Contract awarded to Fredrickson & Watson Construction Co., Oakland, $811,180.86.

SAN MATEO COUNTY—Bay Shore Freeway from Broadway in Burlingame to State Street in San Mateo, about 2.2 miles to be graded and paved with Portland cement concrete on crusher run base. District IV, Route 68. Macco Construction Co. & Morrison Knudsen Co., Inc., San Bruno, $696,892.50; Chas. L. Harney, San Francisco, $760,212.55; Fredrickson & Watson Construction Co., Oakland, $874,926.70. Contract awarded to Guy F. Atkinson Company, South San Francisco, $627,781.90.

SAN MATEO COUNTY—In South San Francisco, between Southern Pacific Railroad and 0.5 mile southerly, about ½ mile to be graded and sand drains to be constructed. District IV, Route 68. Morrison Knudsen Co., Inc., and Macco Construction Co., San Bruno, $294,182.50; Dan Caputo & Edward Keeble, San Jose, $304,671; Chas. L. Harney, San Francisco, $328,165.80; Guy F. Atkinson Co., South San Francisco, $333,037; Eaton & Smith, San Francisco, $342,134.80; Peter Sorensen, Redwood City, $379,782.50. Contract awarded to Piombo Bros. & Co., San Francisco, $270,446.50.

SAN LUIS OBISPO COUNTY—Between Santa Maria River and 1.5 miles south of Nipomo, about 2.1 miles, the existing surfacing to be repaired by constructing crusher run base, placing plant-mixed surfacing thereon and applying Class "C-Fine" seal coat and Class "D" seal coat thereto. District V, Route 2, Section F. Brown-Doko & Baun, Pismo Beach, $98,813; Granite Construction Co., Watsonville, $106,568. Contract awarded to Fairey-Hammond, Inc., San Francisco, $95,750.

SHASTA COUNTY—Between Cottonwood and Anderson, about 10.8 miles to be graded and surfaced with plant mixed surfacing. District II, Route 1072. Marshall S. Hanrahan, Redwood City, $208,900.50; A. Teichert & Son, Inc., Sacramento, $256,370.50; Harms Bros., Sacramento, $271,953. Contract awarded to Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, $206,123.50.

SOLANO AND SONOMA COUNTIES—Across Sonoma Creek, about 10 miles west of Vallejo, the steel floor system of the existing bascule span to be replaced. Districts X, IV, Route 208, Sections A,A. Lord & Bishop, Sacramento, $3,200. Contract awarded to M. A. Jenkins, Sacramento, $2,190.

TULARE COUNTY—Between 3.6 miles and 0.1 mile south of Kingsburg, about 3 miles in length to be repaired with plant mixed surfacing and seal coat. District VI, Route 4, Section E. Contract awarded to Valley Paving & Construction Co., Inc., Fresno, $32,160.

YOLO COUNTY—Between Woodland and Knights Landing, about 9.5 miles, crusher run base borders to be constructed and seal coat applied thereto. District III, Route 87, Section A. McGillivray Construction Co., Sacramento, $37,575; Milo A. Browne, Palo Alto, $38,817.50; Fredrickson Bros., Emeryville, $39,679.50; J. Henry Harris, Berkeley, $40,174.20; Harms Bros., Sacramento, $41,023.50. Contract awarded to Folsom & Drollinger, Sacramento, $34,553.

YOLO COUNTY—At Tule Canal about six miles east of Woodland, a reinforced concrete slab bridge to be constructed and 0.24 mile of approaches to be graded and bituminous surface treatment applied thereto. District III, Route 50, Section E. Erickson, Phillips & Weisberg, Oakland, $99,685.30; Transwestern Construction Company, Sacramento, $118,747.29. Contract awarded to M. A. Jenkins, Sacramento, $79,740.

YUBA AND SUTTER COUNTIES—Between D Street Bridge in Marysville and Route 15 in Yuba City, a length of about 2 miles, a four lane divided highway to be constructed and surfaced with asphalt concrete pavement on cement treated base. District III, Route 3. H. Earl Parker and N. M. Ball Sons, Marysville, $634,708. Contract awarded to Lester L. Rice, Marysville, $594,741.

JULY, 1946

ALAMEDA COUNTY—Between Maitland Drive and Earhart Road in the Auxiliary Naval Air Station, Oakland Airport, about 0.2 mile to be repaired with plant-mixed surfacing and shoulders to be constructed of crusher run base. District IV, Independent Construction Co., Ltd., Oakland, $4,203.50; Fredrickson & Watson Construction Co., Oakland, $4,241.50; J. R. Armstrong, El Cerrito, $4,307.01; Lee J. Immel, San Pablo, $4,642.50. Contract awarded to Gallagher & Burk, Oakland, $4,180.30.

ALAMEDA COUNTY—Over the tracks of the Southern Pacific Co., near El Cerrito Hill, in the city of Albany, painting steel superstructure of overhead crossing on State highway. District IV, Route 69. D. E. Burgess Co., San Francisco, $10,928; D. Zelinsky & Sons, San Francisco, $11,795; Kiss Crane Co., San Pablo, $17,800.97. Contract awarded to Pacific Bridge Painting Co., San Francisco, $8,303.95.

CONTRA COSTA COUNTY—Between junction of Routes 106 and 75 and 0.1 mile east of Port Chicago Road, about 2.6 miles to be graded, paved with Portland cement concrete and asphalt concrete pavement placed on crusher run base and plant mixed surfacing placed on the shoulders. District IV, Route 75, Sections B,C. Fredrickson & Watson Construction Co., Oakland, $569,069.95; N. M. Ball Sons, Berkeley, $578,668.75; Fredrickson Bros., Emeryville, $580,708.90; A. Teichert & Son, Inc., Sacramento, $620,275; Guy F. Atkinson Company, South San Francisco, $653,020.50; Chas. L. Harney & Piombo Bros. & Co., San Francisco, $668,136; Marshall S. Hanrahan, Redwood City, $769,055.50. Contract awarded to Harms Bros., Sacramento, $561,202.

LAKE COUNTY—Across Kelsey Creek at Kelseyville, a structural steel girder bridge and approaches to be constructed. District I, Route 89, Section D. Peter Sorensen, Redwood City, $206,472. Contract awarded to A. Sola and Son, Oakland, $201,711.84.

LOS ANGELES CITY—On and adjacent to Santa Ana Parkway between Soto and Indiana Streets, grading, storm drain and sanitary sewer construction to be performed. District VII, Route 2. Haddock Co., Pasadena, $424,001.25; Chas. T. Brown Co., San Fernando, $430,032.70; Peter Kiewit Sons' Co., Arcadia, $498,397. Contract awarded to Mike Radich & Co., Burbank, $389,651.50.

LOS ANGELES COUNTY—On Santa Ana Parkway, at First Street in the city of Los Angeles, a reinforced concrete undercrossing to be constructed. District VII, Route 2. The Contracting Engineer's Co., Los Angeles, $183,823; Guy F. Atkinson Co., Long Beach, $197,779; Peter Kiewit Sons' Co., Arcadia, $205,635.50. Contract awarded to Haddock Company, Pasadena, $170,356.36.

LOS ANGELES COUNTY—At intersection of Anaheim-Telegraph Road and Washington Blvd., and at intersections of Sepulveda Blvd. with El Segundo Blvd. and Rosecrans Ave., traffic signal systems to be furnished and installed. District VII, Routes 166,60. C. D. Draucker Co., Los Angeles, $24,540. Contract awarded to Econolite Corp., Los Angeles, $23,434.

MADERA, KINGS, TULARE COUNTIES—Near Califa and between Hanford and Route 4, about 16.8 miles, seal coat to be applied. District VI, Routes 140, Sections BC,A,A. Vinnel Company, Alhambra, $21,479. Contract awarded to Valley Paving & Construction Co., Fresno, $17,050.

MARIN COUNTY—Between Waldo and Ignacio, a length of about 1.5 miles to be repaired with asphalt concrete pavement and shoulders to be constructed of crusher run base and penetration treatment applied. District IV, Route 1, Sections D,C,A. E. A. Forde, San Anselmo, $67,306.50; A. G. Raisch Co., San Francisco, $69,324. Contract awarded to Brown-Ely Co., Contractors, El Cerrito, $64,301.50.

MARIN COUNTY—Across Novato Creek about 9 miles north of San Rafael, repairing a portion of a bridge. District IV, Route 8, Section A. Evans Construction Co., Berkeley, $10,222.50; Kiss Crane Co., San Pablo, $11,995. Contract awarded to Wm. B. Willett Co., San Francisco, $5,607.16.

MONO COUNTY—Between Route 23 and Sheep Corral, about 6.3 miles to be surfaced with road-mixed surfacing. District IX, Route 40, Section C. Basich Bros. Construction Co. and Basich Brothers, Alhambra, $35,212; Brown, Doko & Baun, Pismo Beach, $36,128; Roland T. Reynolds, Anaheim, $39,435.50; Pacific Rock & Gravel Co., Monrovia, $39,977.40. Contract awarded to Geo. E. France, Visalia, $20,937.

PLACER AND NEVADA COUNTIES—Between 4.7 miles west of Tahoe City and 1.7 miles south of Nevada County line and between Truckee Wye and Church Street in Truckee, about 8.5 miles, portions to be repaired with plant-mixed surfacing and seal coat and a portion to be graded and surfaced with crusher run base and plant-mixed surfacing. District III, Route 38, Sections B,C,A. Fairey-Hammond Inc. and R. A. Farish, San Francisco, $164,367. Contract awarded to Clements & Co., Hayward, $135,790.

SAN DIEGO COUNTY—At Main Entrance to Camp Pendleton, a traffic signal system to be furnished and installed. District XI, Route 2, Section C. California Electrical Works, San Diego, $7,800; Econolite Corp., Los Angeles, $8,100. Contract awarded to Tri-Cities Electrical Service, Oceanside, $5,190.

(Continued on next page)

New Law Clarifies Toll-Free Privileges of Federal Government on Bay Bridge

SIGNING by President Truman on July 1 of H.R. 3565 (Public Law 477—Seventy-ninth Congress—Chapter 528, Second Session) clarifies the toll-free privileges of government traffic on the San Francisco-Oakland Bay Bridge. Submission of the question to Congress rather than court action was determined upon as the better plan to eliminate friction between State and Federal agencies over interpretation of provisions respecting tolls inserted in the Federal permit of August 20, 1932, and the subsequent interpreting agreement of December 16, 1938.

Incidentally, the act will increase revenues of the bridge $300 to $400 per day, or approximately $9,000 per month. It is estimated the new law will eliminate 1,200 to 1,500 vehicles per day from the toll-free traffic using the span.

The act was drafted by the Legal Division of the Department of Public Works and presented to California Congressional representatives with the approval of the California Toll Bridge Authority. It became effective on July 31, and accomplishes these purposes:

The act, which was drafted by the Legal Division of the Department of Public Works, and which became effective on July 31, accomplishes these purposes:

1. Military, Coast Guard, and Naval personnel, and civilian employees of the Army, Navy and Coast Guard, and personnel and employees of the Coast and Geodetic Survey, when such personnel or employee are engaged in the performance of official duties requiring the use of the bridge, together with the conveyances being used by them in the performance of such duties.

2. Military, Coast Guard and Naval personnel, civilian employees of the Army, Navy and Coast Guard and personnel and employees of the Coast and Geodetic Survey, and their dependents, when such personnel, employees or dependents are resident or employed on Yerba Buena Island or Treasure Island, or any vessel berthed at any point on said islands, together with the conveyances being used by them when proceeding to or from the island.

Toll-free privileges enjoyed by civilian departments of the Federal Government and contractors of the government are abolished. These privileges originally were demanded by the Federal Government as consideration for the use of the right of way for the bridge across Yerba Buena Island accorded by the joint permit of 1932.

The measure was sponsored in the House of Representatives by Congressmen Franck R. Havenner and Richard J. Welch of San Francisco, Congressmen John H. Tolan, Oakland, and George P. Miller, Alameda, and in the Senate by Senator Wm. F. Knowland of Oakland, a member of the subcommittee of the Commerce Committee of the Senate which considered the bill and reported it out favorably.

The act provides that the authorization for toll-free privileges shall be issued and signed by an officer or official designated for such purposes, in accordance with regulations to be prescribed by the Secretary of the Department having control of the personnel exempted by the act, namely, Secretary of War, Secretary of the Navy, Secretary of the Treasury, and Secretary of Commerce. This is a change from the previous procedure whereby all such passes were issued through the Commandant of the Twelfth Naval District.

Redwood Highway Project

(Continued from page 15)

from two of the large rocky cuts near the southerly limits of the project.

Roadway grading is still the major operation on the project involving the use of various types of excavating equipment including two 2-cubic yard power shovels, four Wooldridge Terra Cobra earth movers and several caterpillar tractor and LeTourneau carryall units.

For paving materials, the contractor is erecting a batching plant adjacent to the Northwestern Pacific Railroad about midway on the project.

Travel on this highway is heavy the year around, augmented during the summer season by a large volume of vacation traffic between the San Francisco Bay Area and the Russian River resort district as well as northern interstate traffic through the Redwood Empire.

This project was prepared during the war for construction as a postwar project and was awarded to A. G. Raisch Company and Harms Brothers on January 17, 1946, at a construction cost of $1,680,000. Three hundred and ninety working days were allowed to complete the project which should make the improvement available for the heavy summer traffic of 1947.

P. S. Harless of A. G. Raisch Company and J. A. Sheldon of Harms Brothers are superintendents in charge of construction.

The work is under the general supervision of Jno. H. Skeggs, District Engineer, District IV, Division of Highways, with W. A. Rice as Resident Engineer.

Highway Bids and Awards

(Continued from preceding page)

SANTA CLARA COUNTY—At San Jose, between Bascom Avenue and Park Avenue, about 1.3 miles to be graded and paved with asphalt concrete on Portland cement concrete base and existing pavement. District IV, Route 5, Sections B,S.Is. A. J. Raisch Paving Co., San Jose, $189,174.95; Chas. L. Harney, San Francisco, $201,520.30. Contract awarded to Union Paving Co., San Francisco, $183,663.40.

STANISLAUS AND SAN JOAQUIN COUNTIES—Between Salida and one mile north of Ripon, about 4.5 miles to be graded and paved with Portland cement concrete. District X, Route 4, Section B,A,Rip. M. J. B. Construction Co., Stockton, $428,649; Louis Biasotti & Son, Stockton, $429,809.70; N. M. Ball Sons, Berkeley, $448,440.98; Clyde W. Wood, Inc., North Hollywood, $457,016.50; Marshall S. Hanrahan, Redwood City, $479,008.10. Contract awarded to A. Teichert & Son, Inc., Sacramento, $420,336.85.

TEHAMA COUNTY—Between 3 miles east of Paynes Creek and Morgan Summit, a distance of about 21.4 miles, seal coat to be applied. District II, Routes 29, 86, Sections B,A. J. Henry Harris, Berkeley, $46,433.25; Sheldon Oil Company, Suisun, $50,210. Contract awarded to Morgan Construction Co., Pleasanton, $38,815.

SOLANO AND YOLO COUNTIES—Across Putah Creek, about 6 miles north of Dixon, a bridge to be repaired. District X, Route 7, Sections E,A. Fred Kaus, Stockton, $11,847.60; Evans Construction Co., Berkeley, $12,913; C. C. Gildersleeve, Willows, $13,910; Kiss Crane Co., San Pablo, $14,647.07; Bati Rocca, Stockton, $13,954. Contract awarded to M. A. Jenkins, Sacramento, $8,086.50.

LOS ANGELES COUNTY—Between Sixth Street and 0.4 mile north of Imperial Highway about 1.0 mile to be repaired with plant-mixed surfacing and shoulders to be widened with imported borrow and bituminous surface treatment applied thereto. District VII, Route 170, Section A. Oswald Bros., Los Angeles, $17,906; Griffith Co., Los Angeles, $18,460. Contract awarded to Cox Bros. Construction Co., Stanton, $16,696.

In Memoriam

Abram N. George

ON May 6, 1946, Abram N. George, one of the original employees of the Division of Highways, passed away at Los Angeles.

During his many years in State service, Mr. George was one of the most capable, conscientious and outstanding employees, whose leadership and helpful cooperation endeared him to all who knew him.

Mr. George was born on May 27, 1890, at Hastings, Nebraska, and his family moved to California during his childhood, settling at San Diego. Shortly after finishing school he entered the employ of the San Diego County Highway Commission where he worked until 1912.

When the State Highway Department was organized in 1912 Mr. George started as instrumentman and his name appears on the first pay roll of District VII. He was soon promoted to Chief of Party, in which position he worked until 1917 when he entered the Army Air Force. During the first World War he rendered distinguished service in France.

On April 7, 1919, he returned to work in District VII and worked as Chief of Party and Resident Engineer until 1932, at which time he was appointed Assistant District Construction Engineer. On June 15, 1934, he received the appointment of District Construction Engineer, which position he held until his death.

Mr. George is survived by his widow, Josephine K. George, two sons, Abram N. George, Jr., USNR, and Jack Alan George, of Pasadena, and a sister, Mrs. Emma Sherburn of San Diego.

S. F. POLICE URGE CARE IN PARKING ON CITY'S HILLS

Motorists planning to visit San Francisco are urged by Police Chief Charles W. Dullea to make certain, when parking on any of the city's hills, that their wheels are cramped against the curb and their emergency brakes are effectively set.

"The menace of runaway automobiles in San Francisco is ever-present," declared Chief Dullea. "Not a month passes that 60 or more runaway cars are not reported to the police department. At times, we have had as many as 80 reported during a month. A number of persons, including little children, have been killed by these driverless cars. Many others have been injured. The property damage, to the runaway car, to other automobiles, and to stores and homes, runs into thousands of dollars.

"In view of this danger, we want to appeal to every motorist to do two things, if he must park on any perceptible grade, no matter how slight. The first is to make certain the emergency or parking brake is pulled on just as far as it will go. The second is that the wheels are firmly blocked against the curb. As an extra precaution, the car can also be left in gear—reverse if the car is headed downhill, low gear if it is headed upgrade."

In Memoriam

Ray Edwards

ON May 24, 1946, death claimed Mr. Raymond Phillip Edwards, Assistant Engineer in District X Office. Mr. Edwards had been with the Division of Highways since May, 1934, and continuously with District X from May 3, 1936, to the date of his death. Mr. Edwards' untimely death followed a brief illness which confined him to a hospital, resulting in surgery, from which he failed to recover.

The district and the Division of Highways will feel his loss as he was a very congenial individual and an excellent and efficient worker. Because of physical handicap, Mr. Edwards was not able to get into military or armed services of this country but was a great help to the boys of the department that were in the armed services and particularly to those who went overseas. He maintained a letter contact with each and every service man from the staff of District X office and through this contact, kept each of the several employees informed of the whereabouts of the others. Mr. Edwards' appearance in any group was as welcome as a ray of sunshine.

He was born in Chicago on October 1, 1911, and received his education in public schools in San Francisco and later attended Healds Engineering College where he received his engineering education.

Mr. Edwards leaves a mother, Mrs. Esther Edwards, and two brothers, Mr. Carl Edwards and Mr. Robert Edwards, all residing in San Francisco.

Embankment Stabilization at Terminal Island

(Continued from page 10)

the Anaheim Street approach overhead crossing at Nicholson Avenue.

The quantities involve 682,000 pounds of structural steel, 1,468 cubic yards Class A concrete, 188,000 pounds bar reinforcing steel, and 1,560 tons asphaltic concrete (paving).

HIGHWAY STRUCTURES

James I. Barnes Construction Company, Santa Monica, holds an important contract on the route, consisting of highway and structures in both the Cities of Los Angeles and Long Beach, on the Pacific Coast Highway between Dominguez Channel and San Gabriel Avenue, about 0.7 mile. Work includes grading, paving with asphaltic concrete, and constructing four bridges. The total cost is about $1,672,000.

Individual units in the bridge construction are: An overpass across Terminal Island Freeway; a bridge over the Union Pacific Railway; a bridge over the Harbor Commission marshaling yards; and a bridge over Dominguez Channel.

Some of the major items in the quantities are: 48,400 cubic yards excavation, 20,000 cubic yards compact original ground, 712,600 tons imported borrow, 37,500 tons imported subgrade material, 53,000 square yards prepare Class C subgrade, 1,400 tons plant mix surfacing, 21,500 tons asphaltic concrete, 7,716 cubic yards Class A concrete in structures, 685 cubic yards Class A concrete in footing blocks, 3,788,000 pounds structural steel, 1,171,000 pounds bar reinforcing steel, 42,380 lineal feet timber piling, 1,700 lineal feet cast-in-place concrete piles, 22,920 lineal feet steel piling, 1,300 cubic yards concrete in curbs, gutters, sidewalks, 950 feet pipe and rail, 2,800 lineal feet chain link fence, about 5,000 lineal feet 18-inch to 36-inch reinforced concrete pipe, 29,000 pounds iron and steel, 2,445 feet steel railing, 18,300 plants for bank stabilization, and a galvanized metal bin-type retaining wall.

SHADE TREE CONFERENCE BRINGS OUT VALUABLE INFORMATION

By H. N. BOSWORTH, Assistant Highway Landscape Engineer

INTEREST in the profession and the desire for a better understanding of their work was the incentive for 13 highway tree maintenance foremen, one groundsman and gardener, and two assistant highway landscape engineers from the Division of Highways to attend the thirteenth meeting of the Western Chapter of the National Shade Tree Conference in Riverside, California, recently.

Members of the National Shade Tree Conference represent municipal, county, State and Federal agencies, universities, private concerns specializing in landscape and ornamental tree work, many industries affiliated with such work and some who are "just tree lovers." These men are mutually interested in trees, and represent every phase of the work necessary in the perpetuance of trees. Needless to say there is much of value for the Division of Highways in such a gathering, and conversely the Division of Highways with its extended territory and variety of environmental conditions can offer much to the conference through its tree foremen who are handling that work.

Field demonstrations convincingly told the practical story of the use of power-driven equipment in modern tree care. Chain-saws of various makes vied for honors in cutting trees down and into fireplace lengths; an air-driven model was used to top a towering eucalyptus 40 feet off the ground; holes for tree planting 24 inches in diameter and five feet deep were dug by machine in less time than the top layer could be dug out by hand with a shovel; trees were sprayed from atop a hydraulically lifted tower 30 feet above its parent body, the high pressure spray rig, with pressures up to 600 pounds and a discharge of 50-60 gallons per minute, and the practical use of rope when climbing in trees, were all part of the action picture.

A number of vital papers were presented to the conference. Of particular value to our tree foremen were the two dealing with newly developed fungicides and insecticides.



Field demonstrations of new power-driven tree cutting equipment

Dr. A. M. Boyce of the Citrus Experiment Station, Riverside, California, presented a comprehensive review of the newest developments in the field of insecticides.

In the past, insecticides have been developed to act on the insect either by contact with its outer body as a caustic, or on its respiratory system as a suffocant, or as a stomach poison. A new development in the form of DDT acts upon the nervous system of the insect. The much publicized DDT, according to Dr. Boyce, may be only the forerunner of more startling insecticides to come.

A British product known as "666" and a United States product called "1068" are now more powerful than DDT, but are too dangerous for general use. New insecticides are so chemically complex, with the difference sometimes of only a molecule or two between two products, that the use of numbers or letters for names has been accepted by the trade in preference to complicated meaningless names to confuse the public. The numbers are often the collection of molecules represented, but in no way indicate chemical content.

(Continued on page 32)

Fifth Avenue Overhead on East Shore Freeway is Started

(Continued from page 17)

economy since it reduces the total vertical rise of the roadway. As best suited to the conditions, 36-inch steel rolled beam spans of lengths varying from 50-feet to 80-feet were selected.

Timber piles will be driven to support reinforced concrete footings. Most of the bents carrying the beams will consist of reinforced concrete columns and caps. At the crossing over the Western Pacific Railroad, restricted clearance and high column loading made the use of structural steel columns and floor beams desirable.

Earth embankment heights on the approaches were limited to less than 10 feet, due to the low supporting capacity of the foundation material. This consideration determined the length of the structure.

A subway type structure was not used, since high ground water and unfavorable foundation material would have made construction and maintenance costs prohibitive.

The span layout consists of beams continuous over two bents, alternating with suspended beams carried on hinges at the cantilever ends of the continuous spans. This provides for a maximum amount of flexibility if the footings should move.

An interesting feature of the design is the use of a simplified type of hinge, especially adaptable to change in alignment between successive girders. Instead of the usual two steel pins and hanger bars, a single horizontal steel bar set on a shelf of the supporting beam will carry the end of the suspended span. Keeper plates will maintain the position of the girders. Fabrication and erection problems are thus simplified.

Bearings supporting the beams at the bents are of a similar type. A single horizontal steel bar resting on a base plate supports the beams. Keeper plates are used to prevent lateral shifting. This design eliminates the usual more elaborate top and bottom bearing assemblies and steel pin.

A reinforced concrete deck slab and curbs will form the roadway surface. Steel hand railing will be used to provide a reasonably unobstructed view from the roadway, and also to accentuate the lightness of the structure as a whole.

Drainage will be removed from the deck through drains and discharge pipes to disposal points at each end of the structure.

Temporary tracks and turnouts will be laid to maintain traffic during construction of footings. Three thousand feet of new drill track and turnouts will be placed to maintain permanent connections to existing sidings along the south side of the structure. Two thousand six hundred feet of new track and guard rail will be laid to restore the tracks to order, within railroad right of way.

This work will be done by the contractor's forces due to a shortage of labor on the railroad crews.

CONSTRUCTION OF STREETS

An embarcadero street will be constructed along the south side of the structure, parallel to the new drill track from Fifth Avenue to Ninth Avenue. This will provide vehicular access to properties in this area.

At the time the approach highways are built other outer highways that will encircle a portion of each end of the overhead structure will also be constructed to give access to further property in this vicinity.

An indication of the complexity of clearing the various phases of a structure of this type and location for contract is indicated by listing the various agencies represented at a general conference held some time ago. They were:

Bridge Department, State of California; District IV, Division of Highways; Right of Way Department, State of California; City of Oakland; Port of Oakland; Southern Pacific Company.

Not present at this meeting, but also interested in the project are: Western Pacific Railroad Company; Pacific Gas and Electric Company; East Bay Municipal Utility District; Public Roads Administration, United States Government.

The design problem is thus seen to be not merely a relatively simple problem of laying out a highway and series of crossing structures. Immediately as decision was made to locate the freeway through this area, it became obligatory for the personnel of the Division of Highways to see that all proper interests were protected and provided for. It is a far cry from completing plans for a modern freeway in a metropolitan area to doing the same in open rural areas.

The route to follow must be located to serve the most persons anticipated to use it, and at the same time to cause the minimum amount of damage and inconvenience to persons and property already in that area. Right of ways, easements and other agreements must be obtained to permit the freeway to traverse the site. The detail layout and design of the structures and highway proper follow. This is not all.

Approaches must be provided at suitable points to allow vehicles to enter or leave the freeway. This involves construction of connecting roads, outer highways and often other crossing structures.

Opportunity to cross from streets on one side of the freeway to the other are planned at intervals. To avoid conflicting streams of traffic at the same level, these crossings will be made on structures passing over the freeway.

Finally, the interests and rights of the railroads and public utilities must be cared for.

CONTRACT DATA

A period of 14 months has been allotted for the completion of the work.

The estimated major quantities of work are:

Roadway Excavation	3,800 cu. yds.
Structure Excavation	15,030 cu. yds.
Gravel base	2,000 tons
Asphalt concrete	850 tons
Class "A" footing block concrete	4,450 cu. yds.
Class "A" structure concrete	10,610 cu. yds.
Structural steel	3,250 tons
Timber piles	2,917 each
Reinforcing steel	1,375 tons
Removing track	4,100 lin. ft.
Track ballast	1,825 tons
New track	5,720 lin. ft.

The Fifth Avenue Overhead is a portion of the postwar program adopted by the Highway Commission on November 18, 1943. It is being financed jointly by State and Federal funds. The estimated total cost of the structure including contract and supplemental work by the railroads and utilities is $1,832,732.16.

The contract was awarded to A. Stolte, Inc. and The Duncanson-Harrelson Co., Oakland, as joint bidders.

J. E. Burke will act as Resident Engineer for the State during construction.

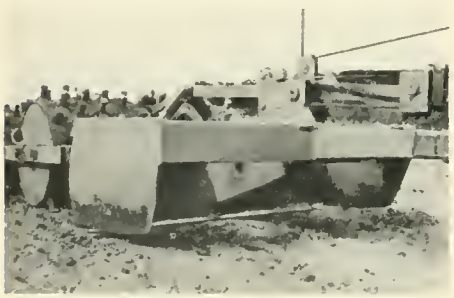
Four-Lane Highway Construction

(Continued from page 6)

and blind stone drains as required to carry off the indicated seepage, and backfilling the areas with selected granular material which tests indicate will be stable even though saturated.

In a few locations, a blanket of beach sand is being placed in the excavated area to provide a drain for disposing of the seepage. After the planned embankments are constructed, the material excavated from the marshy areas is to be used to construct supporting fills against the previously constructed roadway embankment or where suitable, used as topsoil.

Treatment of these marshy areas involves 90,000 cubic yards fill treatment excavation, 3,200 cubic yards sand filling material, 900 cubic yards



Scraper used to level off embankment material ahead of tamping roller

filter material (underdrains), 3,000 lineal feet of 8-inch perforated metal pipe underdrains and about 90,000 cubic yards of roadway excavation.

Excavation materials, in general, are not suitable for subgrade purposes, having lower bearing ratios than considered necessary to provide adequate support for the surfacing. A blanket, or subbase of material selected because of its high bearing ratio and other satisfactory qualities, is being placed full width of the portion of roadbed being added. This subbase is to have a minimum thickness of 6 inches or 9 inches depending on the bearing ratio of the materials over which it is to be placed. Material for this purpose and for backfilling fill treatment areas is being obtained by widening excavation at a location where suitable material was encountered to provide a total of 108,000 cubic yards.

A base course consisting of a 12-inch thickness of crusher run base is to be placed to a width of 24 feet on the traffic lanes. Plant-mixed surfacing is to be placed to a 3-inch thickness over the crusher run base, shoulders, gutters and inside face of embankment dikes. A Class "C-Fine" seal coat consisting of penetration type emulsion and medium fine screenings will be applied to the plant-mixed surfacing on the traffic lanes.

The embankment and cut slopes are composed of materials of a sandy nature that are very erosive. The plans provide, therefore, for treatment of the slopes to preclude excessive future maintenance costs. Excavation slopes are to be covered with top soil removed from within the roadway prism. A 6-10-6 fertilizer is to be mixed with this top soil at the approximate rate of 20 pounds for each 110 square yards of slope area. Straw will then be spread over the excavation slopes and shoved into the loose surface. Top soil selected from fill treatment excavation for its high humus content will be placed over embankment slopes and the central dividing strip.

Upon completion of excavation slope erosion protection and placing of top soil on embankment slopes and the central dividing strip, mesembryanthemum edule (ice plant) cuttings are to be planted on excavation slopes, along the tops of embankment slopes and in the central dividing strip. In addition, the slope areas will be seeded to provide an early protective growth of vegetation.

The contractor is A. Teichert and Son, Inc., Sacramento. The work is being done under the general direction of District Construction Engineer C. E. Waite and District Engineer L. H. Gibson.

Shade Tree Conference

(Continued from page 30)

Dr. George Zentmeyer of the Citrus Experiment Station told of new fungicides developed during the war. Of special value to the Division of Highways was his report that anthracnose or blight on our native sycamores and Oriental planes may now be controlled with one of several new products.

A growing interest and respect is being shown by our highway tree maintenance foremen for the benefits which they derive from the National Shade Tree Conference. Exchange of ideas; contact with commercial men handling tree maintenance products; contact with university instructors and research men, and contact with men of City, State and Federal agencies, give these men a rare opportunity to broaden their knowledge of their chosen work and to apply it in their respective districts.

Those in attendance from the Division of Highways included:

Lloyd Marshall, II; A. J. Bellue, III; Otto Gast and Lewis Barrett, IV; Sylvester Evans, V; Henry Marshall, VI; Aaron Olmstead, Jack Groff, John Mackie, Ordie Marvel and Pete Cowie, VII; Cleveland Taylor and L. L. Brown, VIII; H. D. Martin, XI; and E. S. Whitaker and H. N. Bosworth, Headquarters office, Sacramento.

Garcès Circle - Memorial

(Continued from page 19)

which he refers to as "San Mignel de los Noches por El Santo Principe." Had the Franciscian plans for establishing a mission at this location as a part of a chain of interior missions been carried out, Bakersfield might now be known by some contraction of this sonorous Spanish title.

Garcès crossed the river on a flimsy log bridge and pushed on southward to his first valley base, San Pasquale (Tejon Ranch). The Indians celebrated his return with a feast and dancing.

The missionary left the valley traveling throug Tehachapi Pass and returned to his work among the Indians of the Colorado. His entire sojourn in the San Joaquin Valley consumed only a little more than a month. It is considered one of the epic journeys in all North American history.

The missionary explorer could not know that more than a century and a half later his stone likeness would be benignly surveying multitudes of travelers, passing in swift self-propelled vehicles, over part of the same route on which he had laboriously trudged on foot. Nor could he know that the barren wasteland he had viewed from the foothills, would one day become a vast agricultural empire settled by peoples from nearly every country on the earth. He would sorely miss the simple children of the rancherias.

A fine statue commemorates his martyrdom at Fort Yuma in 1781.

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DIVISION OF CONTRACTS AND RIGHTS OF WAY (LEGAL)

C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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Joint Fact-Finding Committee Hears Report of G. Donald Kennedy on A Ten-Year Highway Program

A COMPREHENSIVE study of California's highway engineering problems, embodying a 10-year program for effecting necessary road and street improvements, has been completed by an independent engineering staff which carried on the project for the Joint Fact-Finding Committee on Highways, Streets and Bridges.

As directed by the 1945 Legislature, an investigation was made of the highway transportation system—State highways, county roads and city streets—to determine the cost and extent of improvements needed to bring existing facilities up to standards adequate to serve present and future requirements of the State.

The facts and recommendations contained in the engineering report, together with separate studies made concurrently on highway finance and taxation, will be reported to the Legislature in January to provide the factual basis for a sound, long-range policy of highway development.

KENNEDY MAKES REPORT

The engineering study was conducted by G. Donald Kennedy, Vice President of the Automotive Safety Foundation, Washington, D. C. Mr. Kennedy's services were made available by his organization with the understanding that the engineering report would not include recommendations on future highway fiscal policy.

Mr. Kennedy made a formal presentation of the report to the committee at a meeting held October 16th in the Senate chamber of the Capitol. By means of enlarged maps, charts and other graphic devices he reviewed the scope of the study and summarized the more important findings.

In attendance with the committee were members of its advisory council, made up of representatives of highway user groups, civic organizations and public officials interested in highway problems.

COMMITTEE MEMBERS

Senate members of the committee in addition to the chairman are George J. Hatfield, Newman; Ben Hulse; El Centro; James J. McBride, Ventura; Thomas McCormack, Rio Vista; Jerrold L. Seawell, Roseville; and Jack B. Tenney, Los Angeles.

Assembly members are Charles W. Stream, Chula Vista, Vice Chairman; Michael J. Burns, Eureka; C. Don Field, Glendale; Gerald P. Haggerty, San Francisco; Charles W. Lyon, Beverly Hills; Bernard A. Sheridan, Oakland; and Frank J. Waters, Los Angeles.



G. Donald Kennedy, Engineering Consultant for the Joint Fact-Finding Committee on Highways, Streets and Bridges

Leading up to the final objective of the study- determination of the cost of an economically justifiable and balanced program of highway improvement covering a 10-year period—Mr. Kennedy explained that the following steps had been taken:

An inventory was made of existing facilities and the amount and character of travel upon them.

Future highway needs were forecast in the light of the State's development and consequent traffic increases.

A proposed reclassification of roads and streets into systems was made according to service rendered, for purposes of jurisdiction, financing, administration, standards of improvement and maintenance.

A study was made to determine design standards which are the minimum to provide facilities for safe and efficient movement of the expected volume and character of travel.

Estimates of present and future needs submitted by the State, counties and cities were compiled and adjusted, with allowances for fluctuations of the price index.

The final step in formulating a sound, well balanced improvement plan was to evaluate the estimates of need, as presented and adjusted, together with engineering facts developed by the study.

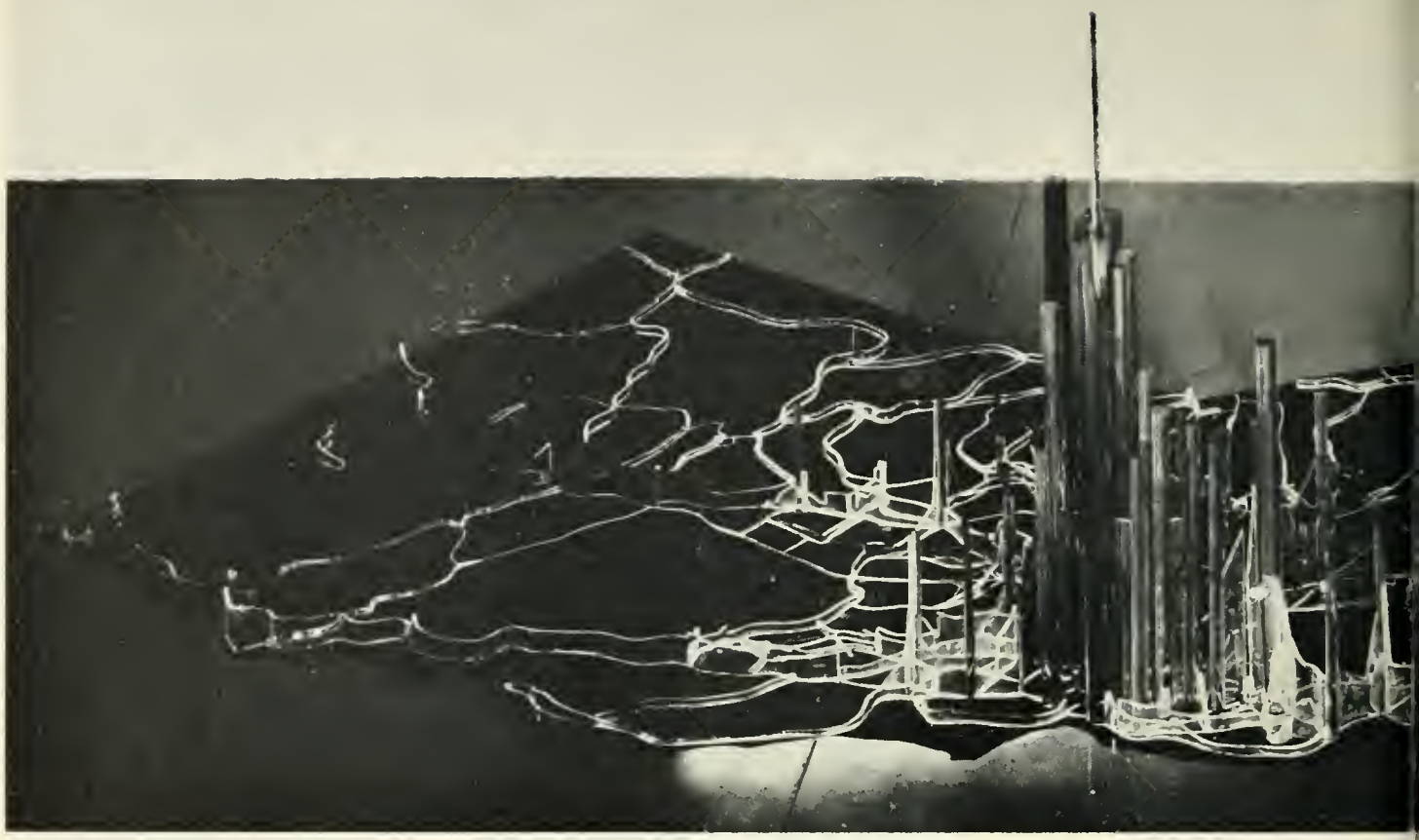
TEN-YEAR PROGRAM

It was considered advisable to plan a 10-year program, as requested by the Legislature. Some of the improvements recommended in the 10-year program will be accomplished during the interim period, within the limits of revenue available. It would not be feasible to supersede plans already made for the next two or three years, although such plans might well be accelerated.

The underlying principle applied in recommending the balanced program was that improvements should first be made where the greatest return on the highway investment would result. This return is measured in terms of safety, economy of vehicle operating cost, saving of time and convenience of movement over roads and streets.

RETURN ON INVESTMENT

The best assurance that return on the investment will be greatest is to provide facilities based on nationally adopted standards as minimums and as related to California's anticipated vol-



TRAFFIC FLOW ON THE CALIFORNIA STATE HIGHWAY SYSTEM. The average number average citizen. Traffic data are essential, however, to engineers in planning, designing, building and operating a proper wide variations in traffic flow are clear. The tall cylinders mark the cities and each vertical plane represents a State average traffic of 250 vehicles a day and the highest point is 70,000 a day at the San Francisco-Oakland Bay Bridge. Vo

ume and character of travel. These standards represent the experience and judgment of the best highway engineering talent in the Nation. They assure highways that will render safe, efficient service at a cost that is economically justifiable.

The 10-year program was presented in the form of annual expenditures for construction, maintenance, administration and other costs shown separately for the State Highway System, County Road System and City Street System.

The final preliminary step to drafting the program was to compile and analyze estimates submitted by the State, counties and cities of the cost of making highway and street improvements which they consider necessary to meet present and future requirements.

Recognizing the magnitude of the task, the committee arranged in advance of the study to gather the required information.

Estimates of cost were requested from the State Division of Highways covering the State system. County information was obtained by means of questionnaires distributed by the County Supervisors Association of California, and the League of California Cities cooperated in a similar manner in gathering data on municipal estimates of cost. The Los Angeles Metropolitan Parkway Engineering Committee provided information for the study of the special problem in its area. All of these original requests for information were supplemented by individual city and county presentations to the committee at hearings held throughout the State.

CALIFORNIA HIGHWAY PROBLEMS

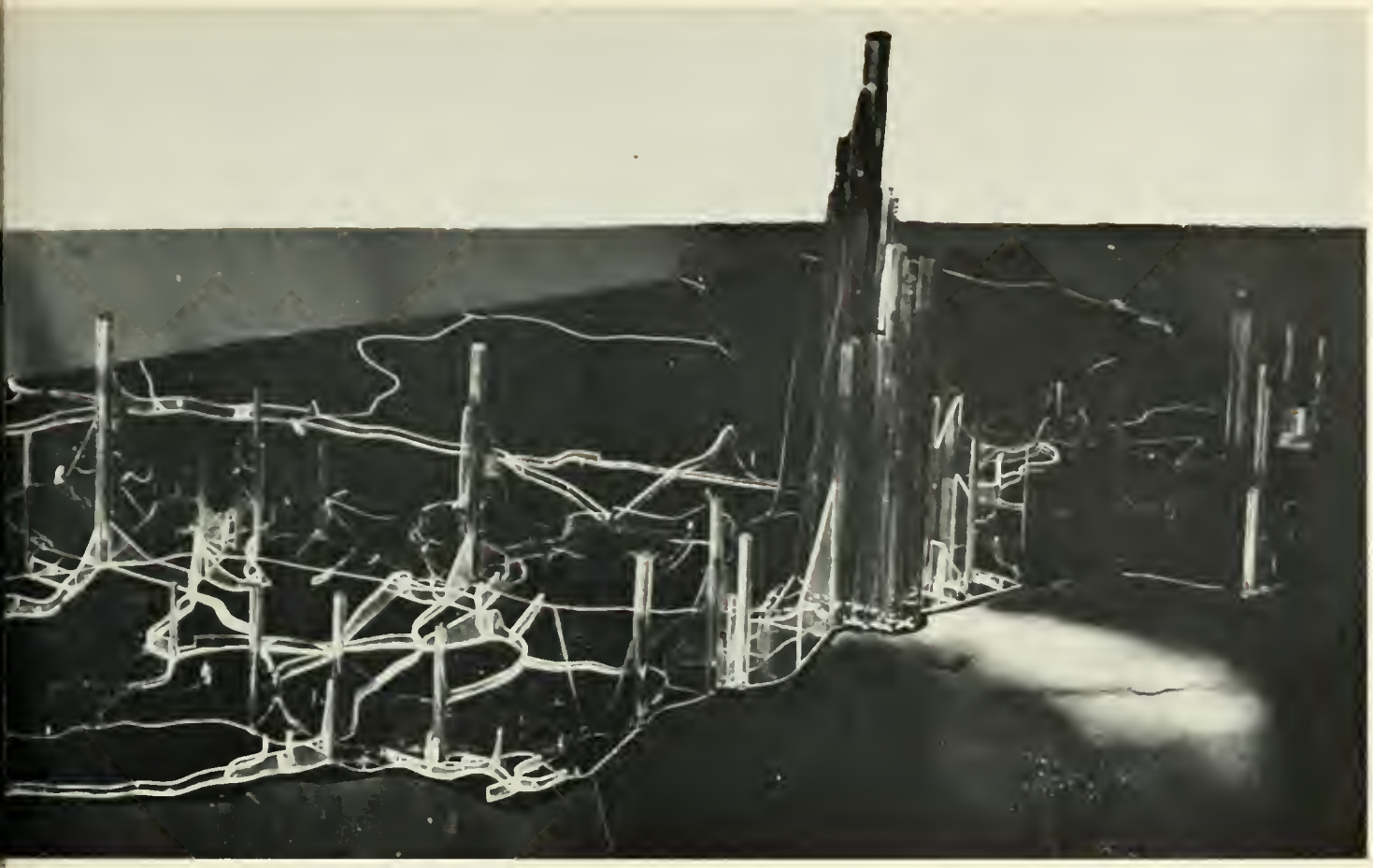
The study began by tracing the historical development of highway transportation in California. Mr. Kennedy pointed out that California highway problems reflect certain distinctive characteristics of the State—its rapid growth, leading position in number and utilization of motor vehicles, the travel habits of its people, its size and geographical position, and extremes of topography and climate.

An appraisal of the highway plant indicated it was deficient when World War II started, progress could not be maintained during the emergency period, and facilities now are inadequate to meet future needs.

Population, mileage of road systems, motor vehicle registration, vehicle miles of travel and accident records were examined as indices by which to measure more exactly the progress of highway development.

From 1912 through 1945 the State invested approximately one and one-fourth billion dollars in highways, of which nearly $832 million was spent by the Division of Highways and the remainder apportioned to the counties. Since 1934, State expenditures in cities averaged $7.9 million per year.

From 1920 through 1945 the counties spent $632 million for road pur-



s using each route of the State Highway System each day combines to a table of figures having little meaning for the system. By expressing the traffic variations in terms of the thin vertical planes of the plastic model photographed here, the with the height proportional to the volume of traffic in each section. Lowest points on the planes correspond to an widely between highways and on different sections of the same highway and increase sharply near the cities.

poses received from Federal funds, State-collected highway user taxes, and general taxes.

In the same period the cities expended $417 million for street purposes received from Federal funds, State-collected highway user taxes, and general taxes.

FEDERAL AID FUNDS

A study was made of the importance of Federal Aid funds in highway development, here and in other States, showing that since 1917 the Federal Government has expended more than $298 million for highway purposes in California. It was noted that the current three-year program involves the spending in this State of $9 million annually for Federal primary highways, $5 million for secondary highways, and $8 million for improvements on Federal aid routes within cities.

An examination of the factors affecting California's future development led to the prediction that highways must be planned to handle the traffic that will result from a population of 11,100,000 in 1960.

The report traced the rapid growth of California since statehood, noted that the population increased nearly two million during the war period, and concluded that on the basis of all available data the rate of growth established from 1920 to 1940 may be expected to continue.

POPULATION GROWTH

It now appears certain, Mr. Kennedy said, that the State will retain a high proportion of its wartime growth, which was more than three times as great as that experienced by any other State. The population passed the nine million mark early this year. In-migration continues at a substantial rate, the birth rate is increasing, and the death rate declining. These facts, together with the State's war-stimulated industrial growth and other favorable economic factors, led to the following population predictions for the next two census enumeration periods:

1950	9,600,000
1960	11,100,000

The prediction was made that California, which now has 3,340,000 motor vehicles registered, would have 5,250,000 in 1960.

With 1946 travel estimated at 32 billion vehicle miles, the prediction for 1960 was 45.8 billion.

Consumption of gasoline, now slightly less than two billion gallons a year, was estimated at 2.68 billion gallons in 1950 and 3.16 billion gallons in 1960.

One of the most important recommendations in the report called for reclassification of the network of roads and streets existing in California for the purpose of providing for the most efficient engineering and administration of the systems.

PLAN OF RECLASSIFICATION

The master plan of reclassification would result in the following approximate mileages:

STATE HIGHWAY SYSTEM

State Expressway System—An integrated network of modern, high design, limited access routes connecting the major centers of population, with extensions into the cities

Rural	2,050 miles
Metropolitan	780
Urban	110
Total State Expressway System	2,940 miles

State Trunkline System—Principal State routes not included in Expressway System

Rural	8,034 miles
Urban	511
Total State Trunkline System	8,545 miles

COUNTY ROAD SYSTEM

County primary system	20,000 miles
Other county roads	45,737
Total county roads	65,737 miles

CITY STREET SYSTEM

Streets of major importance	3,774 miles
Other city streets	14,554
Total city streets	18,328 miles

This reclassification would involve the transfer from the State Highway System to county and city jurisdiction of approximately 2,467 miles of highways of predominantly local interest. It would abolish the present distinction between primary and secondary State highways.

In recommending the designation of a network of principal State highways as the State Expressway System, Mr. Kennedy explained that highest priority of improvement would thereby be possible to provide fast, safe, efficient service between the State's principal cities and to relieve congestion in and around the metropolitan centers.

Design standards set for the Interstate System were recommended as minimums for the State Expressway System, with other nationally accepted design standards to be used in improving the remaining systems.

Throughout the report the part played by modern engineering in building safety into highways was emphasized as an important step in reducing California's currently high traffic death rate.

Legislative and administrative action to help solve the parking problems that exist in every California community were recommended. Development of modern highways leading into cities, the report pointed out, will not result in maximum benefits unless parking facilities are adequate to handle the increased traffic. It was declared to be the responsibility of local government to take the initiative in solving parking problems and to encourge private enterprise to operate off-street lots and garages.

In arranging with Mr. Kennedy to conduct the fact-finding study of the highway transportation system, the committee took into consideration his high professional standing and 20 years of experience in the fields of highway engineering and administration. He resigned as Michigan State Highway Commissioner in 1942 to join the Automotive Safety Foundation as Vice President. He is a former President of the American Association of State Highway Officials, and served as chairman of the postwar construction committee of the American Society of Civil Engineers.

On several occasions Mr. Kennedy has acted as consultant and prepared reports for governmental agencies and congressional committees on problems of highway development. He was Vice Chairman of the National Interregional Highway Committee appointed in 1941 by President Roosevelt. In 1943 he conducted a fact-finding survey of the national highway situation for a Special Senate Committee on Post-War Economic Policy and Planning, and prepared a report entitled "The Role of the Federal Government in Highway Development."

In assembling his staff for the California study, Mr. Kennedy obtained the services of two engineers of wide

(Continued on page 31)



Assemblyman Michael J. Burns of Eureka (left), Chairman of the Assembly Interim Committee on Transportation and Commerce and also a member of the Joint Fact-Finding Committee on Highways, Streets and Bridges; Senator Randolph Collier of Yreka (center), Chairman of the Joint Fact-Finding Committee on Highways, Streets and Bridges; and State Highway Engineer George T. McCoy (right), member of the Advisory Council of the Joint Fact-Finding Committee on Highways, Streets and Bridges, shown departing for the President's Highway Safety Conference in Washington, D. C.

American Association of State Highway Officials Will Hold Annual Meeting In Los Angeles December 17-20

CONFRONTED with problems more serious than any with which it has heretofore had to cope, the American Association of State Highway Officials is preparing for the most important meeting in its history. Its members will hold their thirty-second annual convention in Los Angeles, December 17-20.

During the war, highway construction lagged far behind actual needs in every State in the Union, particularly those on the Atlantic and Pacific Coasts. With the coming of peace, highway officials found themselves facing a multitude of problems ranging from reconstruction of neglected roads to the building of new highways and freeways to care for steadily increasing traffic.

Heavily congested urban areas and rural communities alike have pressing highway needs and how to take care of them will occupy a large portion of the time of the association members at their 1946 meeting.

Committees appointed by George T. McCoy, State Highway Engineer of California, and general chairman, already are deep in convention arrangements. An extensive program of entertainment for the delegates and their wives and families is being mapped.

This is the third time that the American Association of State Highway Officials has chosen California for its meeting place. It met in San Francisco in 1924 and again in 1936. As in the past, the Los Angeles meeting will be highlighted by the attendance of Commissioner of Public Roads Thomas H. MacDonald and his staff between whom and the association there has been close cooperation since 1914 in building the splendid National system of highways of which this country now boasts.

Committees named by General Chairman McCoy are as follows:

Honorary Chairman—C. H. Purcell, Director of Public Works, and Chairman, Highway Commission, California.

Governor Warren Looks Forward to A. A. S. H. O. Meeting

CALIFORNIA looks forward with pleasure to again welcoming the American Association of State Highway Officials. Ten years ago the Association honored our State by holding its twenty-second annual meeting in San Francisco. This year it returns to meet in Los Angeles December 17-20.

Delegates who attended the San Francisco meeting will find great changes have occurred in our State during the intervening years. During the war our population was increased by 2,000,000, and we assumed third position in population among the States of the Nation. Changes have been made in our entire economy and in all our highway needs.

Throughout the war, our State Government gave priority to the victory effort. In doing so, we obviously were forced to delay many important highway improvements, but even during the period when all construction except for war purposes was at a minimum, we were planning for the day when construction would be resumed. We realized that if we were to proceed with public works programs promptly following the war, plans for them would have to be prepared well in advance. And so we pursued a policy wherever possible of having highway surveys completed, rights of way purchased and construction plans finished ahead of authorized construction.

As a result of this policy, we have underway today the largest highway program ever initiated in a single year by our Department of Public Works. But we recognize this program, large as it is, as only the beginning. Our unprecedented growth and our development needs will make highway planning and construction one of our most important activities for many years to come.

General Chairman—G. T. McCoy, State Highway Engineer, California.

Convention Manager—Frank C. Balfour, Chief Right of Way Agent, California.

Program Committee—G. T. McCoy, Chairman; Dr. L. I. Hewes, Chief, Western Headquarters Public Roads Administration; Clarence B. Shain, Director of Highways, Washington; Robert A. Allen, State Highway Engineer, Nevada; R. H. Baldock, Chief Highway Engineer, Oregon; Hal H. Hale, Executive Secretary, American Association of State Highway Officials, Washington, D. C.

Advisory Committee—State Highway Commissioners Harrison R. Baker, Chairman, Pasadena; Homer P. Brown, Placerville; James Guthrie, San Bernardino; F. Walter Sandelin, Ukiah; C. Arnholt Smith, San Diego; Chester H. Warlow, Fresno.

Housing Committee—Lawrence P. Friel, Chairman, Right of Way Agent, District VII Office, Division of Highways, Los Angeles; E. F. Wagner, J. W. Vickrey, Mrs. Asthore Clark, Secretary.

Transportation Committee—S. V. Cortelyou, Chairman, District Engineer, District VII, Division of Highways, Los Angeles; R. H. Stalnaker, T. H. Dennis, J. W. Vickrey, John K. Hess.

Entertainment Committee—Harold Norton, Chairman, Special Representative, Department of Public Works, California; F. W. Panhorst, R. M. Gillis, Fred J. Grumm, Clare P. Balfour, Edward F. King.

Women's Committee—Clare P. Balfour, Chairman; Mrs. C. H. Purcell, Mrs. G. T. McCoy, Mrs. Fred J. Grumm, Mrs. S. V. Cortelyou, Mrs. Jno. H. Skeggs, Mrs. Hodge L. Dolle, Mrs. Harold W. Leonard.

Women's Committee Aides—Harold Norton, Clyde Graham, W. L. Fahey, Neil C. Brown, Wm. L. Mills.

Women's Reception Committee—Mesdames C. H. Purcell, Chairman; G. T. McCoy, Vice Chairman; Fred J.

(Continued on page 32)

Reduction of Fire Hazards Along California State Highways

By E. S. WHITAKER and H. N. BOSWORTH, Assistant Landscape Engineers

THE control of roadside growth to aid in the prevention of fires along portions of State highways of California has become an annual program of importance.

This work is not performed as a matter of roadside clean-up. Its justification is based on recognition of the need for a cooperative program for the protection of agricultural lands adjoining State highways from fires which may originate thereon.

These fires may be started through the carelessness of smokers, by hot carbon from the exhausts of motor vehicles, or from other accidental causes. The program is intended to minimize the number and spread of fires originating from traffic moving on the traveled way or parked on the shoulder area normally available for emergency use.



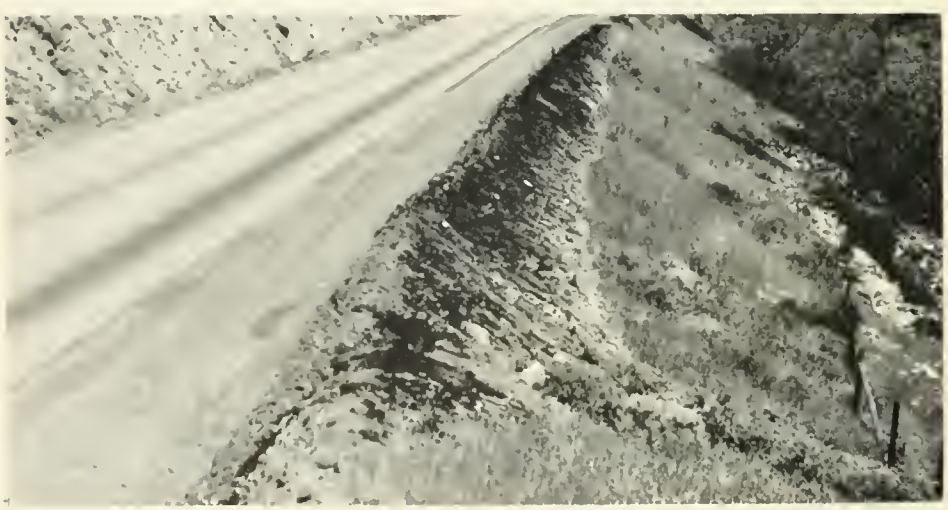
Burned firebreak on a cut slope from the gutter line up

FIRE HAZARD CONTROL

Fire hazard control work is undertaken along roadsides which adjoin pasture lands and grain fields where a fire originating on the highway would quickly get out of control. The density and type of traffic, as well as conditions peculiar to the locality, are deciding factors. This type of work—the programming of fire hazard control work—is necessarily limited as sufficient funds are not available to set up a program on a State-wide basis. No work is done along sections of highways where adjacent land is cultivated, irrigated, or in orchards. Neither is work undertaken where barriers such as rivers, irrigation ditches, or railroads serve as a firebreak.

The program was first initiated in 1926 when extensive fire losses to crops caused underwriters to consider increases in premium rates for this type of insurance. Development of equipment and start of a control program was undertaken early in 1927. In 1928 some 660 roadside miles were cleared or burned at an expense of $37,850 to the State. The program has gradually expanded to take in some 3,000 roadside miles and requires approximately $120,000 to finance the annual cost. This is in addition to work such as plowing firebreaks and burning work undertaken by owners of property adjoining the highways. For the years 1942 to 1945, inclusive, wartime restrictions on use of diesel oil limited the spraying and burning program.

Burned firebreak on a fill slope from the top of the berm out and down



VARIOUS METHODS

Methods of accomplishing the control include the killing of green grass with a diesel oil spray and a follow-up burning after the sprayed grass has become dead and dry, or the control of vegetation by mechanical means—that is, through the use of discing or blading equipment. During the war years, control was obtained as well as possible through discing and blading but due to the nature of the roadsides, there were many miles on which no control could be done. The return to the spray and burn work allows for a more complete control program.

The present practice provides for a control strip six feet wide when sprayed and burned, or the width of one operation if disced or bladed. The sprayed or bladed strip is placed on

or as close to the shoulder as growth demands in order to increase the width between the edge of the traveled way and the nearest roadside fire hazard.

Fire incidence is reduced by controlling the hazard on the area nearest to the point of fire origination. In this location, it also eliminates the possibility of fire starting in the grass that was left between the traveled way and the control strip when placed next to the right-of-way line, as was the previous practice, and of burning along this growth to a point of possible escape to adjoining property. This type of fire occurrence did no particular damage so long as it was controlled by a firebreak between it and the private property; however, it placed an undue amount of work on the State Forestry Department as a result of the policy of that department to dispatch men and equipment for the suppresion of all fires reported in rural areas.



Firebreak behind guard rail



Firebreak on short area between cut and fill slopes in foothill section

BLADING ECONOMICAL CONTROL

Blading, which provides the most economical control, is done on valley, turnpike, and rolling foothill sections with the bladed width placed on the shoulder to control the hazard growing nearest the traveled way. Blading is also carried out on narrow shoulders to afford additional control to the spraying and burning done on cut and fill slopes.

Heavy duty discs are used on areas outside of the gutter line on turnpike or valley sections, or in rolling foothill sections. The disced width is placed outside of but as near to the gutter line as physical features permit for the same reasons noted regarding the sprayed and burned strip. Discing is not undertaken between the edge of the traveled way and the gutter line, it being desired to keep the soil stable in this area. Discing is carried out as near to the point of the cut slope as is reasonable. The sprayed strip along the bottom of the cut slope is extended either to meet the disced strip or is continued along the top of the fill slope, according to the nature of the roadside and the method of control determined advisable. In this manner, the danger of a fire escape at the transition areas is reduced to a minimum.

SOIL STABILITY MAINTAINED

Valley, turnpike, and rolling foothill sections may often be disced or bladed with little danger of solid erosion, whereas other areas that are fairly level require treatment by spraying and burning in order to maintain soil stability. Spraying and burning provides the maximum of protection when placed from the toe of cut slopes up on the slope and from the top edge of fill slopes out and down. In undulating country, a most effective fire hazard control job may frequently result from

(Continued on page 29)

This firebreak was bladed next to right of way line as carried out in 1945



Results Obtained and Experiments Made in Asphalt Subsealing

By H. L. COOPER, Assistant Maintenance Engineer, and
W. R. SOVERING, Assistant Physical Testing Engineer

SINCE the article on "Asphalt Subsealing" appeared in the May-June issues of "California Highways and Public Works," improvements in the equipment, with more efficient methods of operation and more experienced crews, have increased the output and decreased the cost of this type of work to a marked degree.

Observations and experiments made since this work started in March, 1946, give promise that the use of hot liquid asphalt pumped under concrete pavements in order to reduce slab movement and eliminate the pumping condition and also seal the pavement from the bottom side will prove a sound and worthwhile procedure. One district reported that several days after pumping, an inspection showed that of 200 slabs which had previously pumped under traffic, only nine slabs showed any signs of pumping action and these to a lesser degree.

It has been possible to speed up the subsealing work by the use of two 900-gallon asphalt heating tanks which were converted from 1,040-gallon water tanks by Headquarters Shop. These tanks are complete with burners, oil pumps, and pressure hose and are capable of heating cold packaged asphalt to 450 degrees Fahrenheit and pumping directly under the pavement. These two tanks have been constantly in use in Districts IV, VII and X and the results obtained have been very satisfactory.



Three types of nozzles used in asphalt subsealing

INCREASED OUTPUT

After lengthy negotiations with several oil companies, arrangements were made to purchase hot 20-30 penetration asphalt in bulk from one bay area refinery. This was hauled directly to the job, with the result that considerable time has been saved (compared to heating the cold packaged asphalt) with a resultant decrease in cost for the work.

San Francisco and Stockton, Districts IV and X, have been able to take advantage of this service which has been reflected in increased output and decreased costs, as compared to the old method of heating cold asphalt in the small hand operated kettles to which the other districts have been limited.

For work in the City of Tracy, District X was able to obtain railroad tank car delivery of hot asphalt which resulted in the greatest production and lowest cost to date for this type of work. Some 5,200 holes were drilled and pumped on this project, which required 187 tons of asphalt. A daily average of 290 holes were filled at an average of 8.64 gallons of asphalt per hole and at an average of $1.60 each.

On another 3.9 mile section, 3,738 holes were pumped using 150 tons asphalt, or 9.4 gallons at an average cost of $1.62 per hole.

DISTRICT X DRILLS 15,900 HOLES

Since work started this year, District X has drilled and pumped 15,900 holes using 541 tons asphalt, or an average of 8.0 gallons asphalt and at a cost of $2.15 per hole.

District IV, by hauling hot asphalt directly from a bay area refinery, was able to average 188 holes per day on one job. Twelve gallons of asphalt were pumped per hole at a cost of $2.35 per hole.

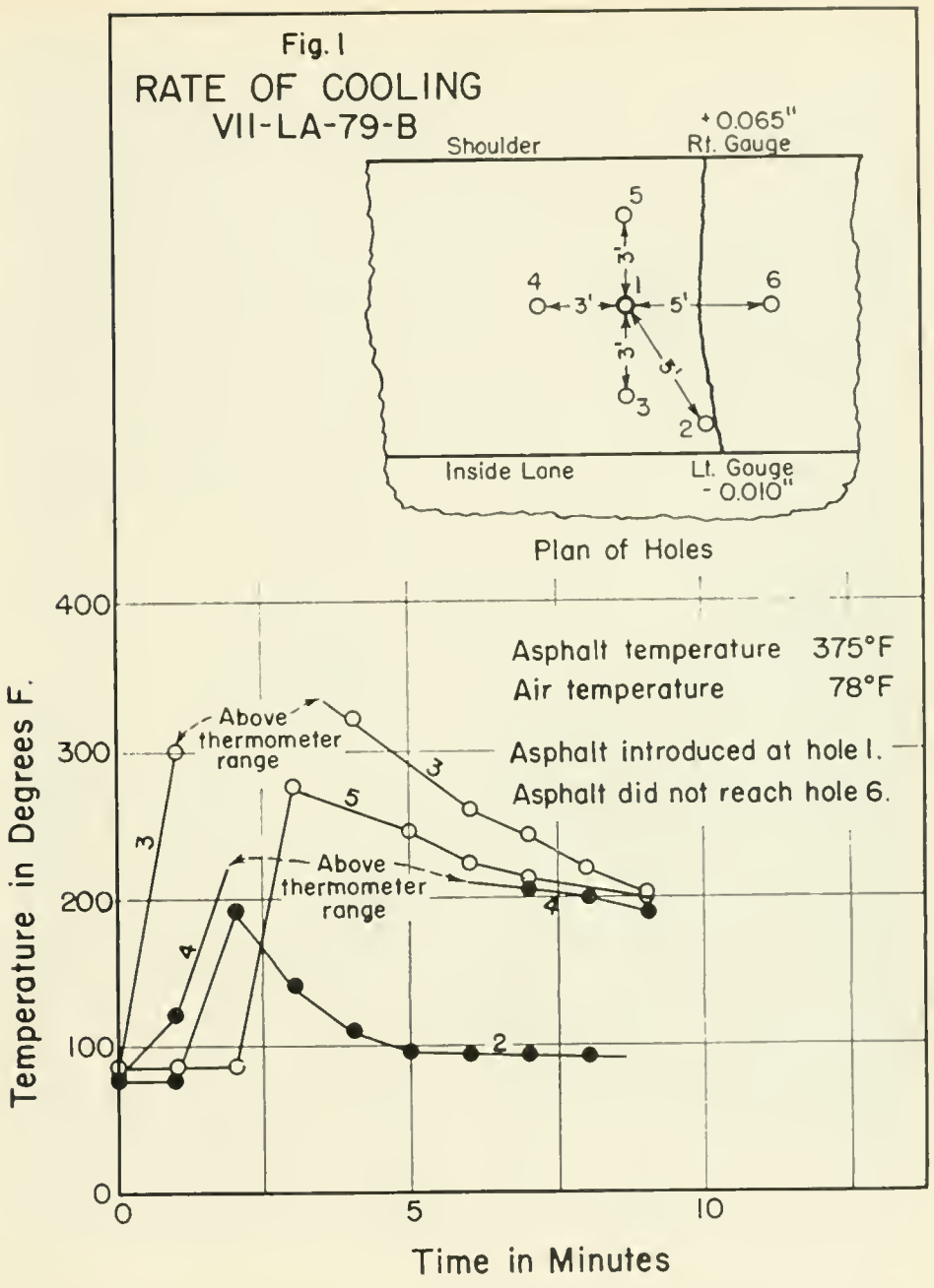
This seasons subsealing work has been completed in Districts II, III, V, VI and XI where the hand-operated asphalt heating kettles of 165 to 400 gallon capacities were used. The equipment used and conditions encountered were reflected in the variation in unit cost of the work which averaged from $2.60 to $4.00 per hole.

Work is still underway in Districts IV, VII and X.

Observations, Measurements and Experiments. In order to improve the asphalt subsealing procedure and to standardize equipment for this work certain observations, measurements and experiments were made in several districts with the help of the Headquarters Laboratory.

Measurements of the temperature of asphalt after injection beneath the pavement and the movement of the concrete slabs, both during subsealing and under loaded trucks, were made to secure information on the following.

1. The rate of cooling of the injected asphalt (which will affect the distance of travel or flow beneath the slab.)
2. The deflection of broken and unbroken slabs under heavily loaded trucks.
3. The magnitude of lift given each slab by the asphalt.
4. The distance to which the asphalt can be forced beneath the pavement.



5. The deflection of slabs both before and after injecting the asphalt.

The measurements of lift and deflection of the slab were made with an Ames dial registering to .001 inch, mounted on a metal support. The support was placed on an adjacent slab or on the shoulder with the dial resting on the slab to be measured. The Ames dial must be handled very carefully to prevent contamination with dust or oil and as the work progressed it was deemed advisable to construct a support which included a suitable protection case for the dial. The support (shown in accompanying photo) was made with a case that completely enclosed the dial but could also be dismantled easily for cleaning. This eliminated the possibility of a sudden blow-out of asphalt making the dial unfit for further use.

Rate of Cooling of the Asphalt. In order to measure the temperature of the asphalt after injection, holes were drilled in the concrete at various distances from the point of injection. Short sections of three-eighths inch pipe were set in jackhammer holes with plaster-of-paris. A small cork was then used to hold Weston or dial type thermometer in place in the pipe. Temperatures were recorded at one minute intervals during injection of

asphalt and at longer intervals as the asphalt cooled. The results of these measurements are shown in **Figures I and II.**

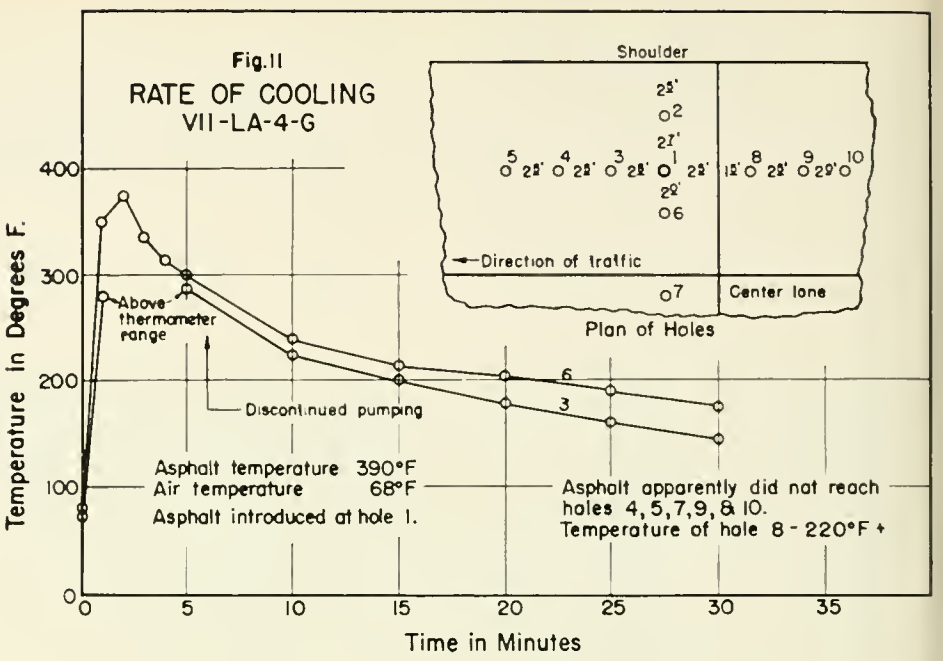
As shown by the graphs, the rate of cooling varies greatly with the thickness of the asphalt layer. It appears from these measurements that in many cases at least one hour is required for the asphalt to cool to normal subgrade temperature.

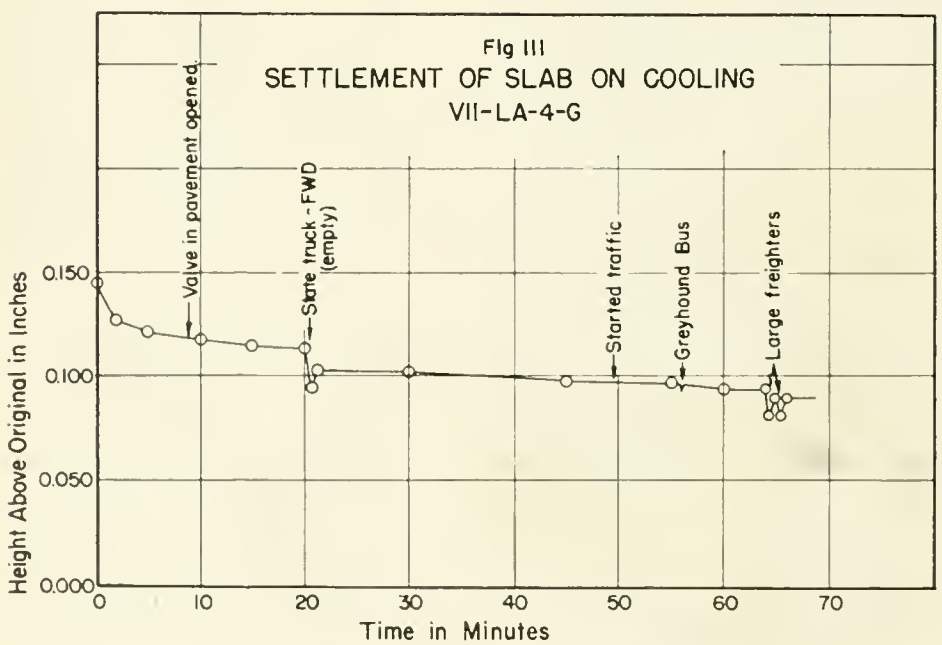
A comparison of the observed temperatures for Hole 2 and Hole 3 on Route 79B, south of Saugus in Los Angeles County, as shown in **Figure I,** shows a longer cooling period was registered at Hole 3. This was apparently caused by a thicker layer of asphalt and leads to the conclusion that there was a larger cavity at this point.

Temperature measurements were not made under slabs where free water was present. However, a more rapid chilling of the asphalt would be expected under these conditions. As the asphalt was pumped under the slabs, water was forced out at the cracks, but as the pumping continued this same water was sucked back under the pavement. This leads to the conclusion that when free water is present the asphalt is chilled in a relatively limited area around the point of injection, causing the slab to be raised on a localized support which creates a partial vacuum at the unsupported corners.

Deflection of Slabs Under Heavily Loaded Trucks. At several locations measurements were made of the movement of slab ends under loaded transport trucks. These several measurements are not directly comparable as the weight of the vehicles was not constant. The measurements do however give an indication of the normal movement of the slabs under typical commercial loads. A deflection of 0.015 inch was measured on a 20-foot slab on VII-LA-79-B under a loaded two-ton truck, and a deflection of 0.025 inch was measured on an unbroken slab under a loaded freighter on VII-LA-4-G (Ridge Route).

On U. S. 50, in the vicinity of Mossdale, there was definite evidence of rocking slabs. A few measurements were made where the end of a 25-foot slab raised from 0.003 inch to 0.005 inch as the loaded truck wheels came in contact with the opposite end. The end of a broken slab moved upward 0.20 inch and downward 0.015 inch registering several complete cycles above and below the normal elevation as the various wheels of a loaded freighter passed over.





INTERESTING MEASUREMENTS

An interesting series of deflection measurements were made between Vallejo and the Napa Wye, on U. S. 40, on pavement constructed in 1944. Measurements made at 7.00 a.m. on July 16, 1946 showed that one end of the slab was moved approximately .003 inch upward as the front wheels of loaded trucks came onto the opposite end of the slab. As the truck progressed along the slab and the rear wheels came on the end being measured a downward movement of approximately 0.025 inch was noted. These measurements confirm profilograph records and indicate that the 15-foot slabs were curled upward and were rocking on the subgrade. Measurements made on these same slabs between 12.30 p.m. and 2.00 p.m., on the same day, after the heat of the sun had expanded the surface of the slab, showed no upward movement and a downward deflection under loaded trucks of only 0.004 inch.

The Magnitude of Lift Given Each Slab by the Asphalt. In the first subsealing work no attempt was made to raise the slab, the object being to force

only sufficient asphalt under the slab to fill cavities and in addition provide a membrane that would seal off the subgrade and prevent further loss of subgrade material through the cracks in the concrete pavement.

The slabs should in all cases be given a lift of from 0.05 inch to 0.1 inch to assure that contraction of the asphalt on cooling will not leave the slab unsupported. A typical example of slab settlement is shown in **Figure III.**

It is not possible by this method to raise slabs which are completely in contact with the subgrade. With the 40 pounds per square inch pressure normally used, it is necessary for the asphalt to spread over an area of approximately three square feet before sufficient hydraulic pressure is exerted to lift a 20- by 11-foot slab.

Distance to Which the Asphalt Can be Forced Beneath Pavement. Temperature measurements and observation of asphalt pumping operations indicate that the asphalt can be forced into any cavity which may exist beneath the pavement. Several cases were noted in which the asphalt forced its way beneath the adjacent bituminous shoulder and came to the surface 12 feet from the point of injection. (Even greater distances have been reported.) As noted above, however, the spread of the asphalt may be restricted by the presence of free water beneath the pavement slab. Additional temperature measurements should be made for a complete study of results obtained where free water is present. The distance to which the asphalt can be forced is determined by the temperature of the asphalt at injection and the size of the void beneath the pavement.

The most satisfactory asphalt injection temperature seems to be from 375 degrees to 425 degrees Fahrenheit.

Deflection of Slabs Before and After Injecting Asphalt. Deflection measurements under a loaded truck were made north of Redding on U. S. 99 on slabs before subsealing with asphalt and again after sealing using an identical load. The second measurements were made the next morning after an elapsed time of 24 hours and showed an average reduction in slab deflection of 60 per cent. The results of these measurements are shown in **Table I.**

Extrusions of Asphalt. During 1944 and 1945 asphalt having a penetration of 40-50 and 30-40 was used. It was found that some extrusions took place due to the fact the asphalt apparently was too soft.



Two views of 900-gallon asphalt tank built by Headquarters Shops for asphalt subsealing

TABLE I

DEFLECTION OF SLABS BEFORE AND AFTER SUBSEALING
II-SHA-3-B

Slab No. †	Deflection Before Subsealing — Loaded Truck * Front Wheel	Deflection Before Subsealing — Loaded Truck * Rear Wheel	Amount of Slab lift produced by Asphalt	Deflection After Subsealing — Loaded Truck Front Wheel	Deflection After Subsealing — Loaded Truck Rear Wheel
1	.016″	.039″	.233″	.000″	.015″
2	.030″	.060″	.110″	.009″	.015″
3	.015″	.027″	.125″	.009″	.019″
4	.050″	.064″	.010″	.009″	.019″
5	.015″	.030″	.077″	.002″	.009″
6	.005″	.023″	.243″	.001″	.008″
7	.014″	.027″	.220″	.004″	.011″
8	.026″	.047″	.330″	.003″	.012″
9	.011″	.030″	Adjacent Slab Raised	.006″	.016″

* Total gross load of truck 20,600 pounds.
† Numbers arbitrarily assigned for these measurements only.





Ames dial used to record pavement raise in asphalt jacking (upper), and for measuring deflection of slabs (lower)

This year asphalt of 20-30 penetration was used in all subsealing work to partially overcome this difficulty. However, in many cases, especially in parts of the State where air temperatures are high, small extrusions still take place where the drill holes have not been filled with cement grout or with wooden plugs. Possibly a slightly lower penetration asphalt should be used in the future for this type of work.

Conclusions

1. The asphalt, after being injected, will cool to subgrade temperature in from 15 minutes to one hour, depending on the thickness of the asphalt layer.

2. Free water under the pavement may chill the asphalt too quickly to permit satisfactory distribution. Additional temperature measurements should be made to secure more data on this phase.

3. The asphalt may be forced into any void beneath the pavement except when free water is present.

4. A lift of 0.05 inch to 0.10 inch should be given to all slabs and lifts up to one-half inch may be given if slabs are low.

5. The deflection of slabs under loads are materially reduced by asphalt subsealing.

Test holes with thermometer inserted to determine flow of asphalt under pavement



Doughnuts Have Holes Too

THE DIARIES of resident engineers on construction projects are usually quite informative as to what is being accomplished and how. On a current project, where rocking slabs of concrete, in an existing pavement, were removed and replaced with other material, a resident engineer's diary contains the following: "Two men and truck maintaining holes in pavement."

Thereby begins what may expand into a far reaching encroachment by the construction engineers on the prerogatives of the maintenance department.

The district maintenance engineer and his assistants, when asked to recommend the best way to maintain holes in a pavement, stood on their constitutional rights and refused to talk.

Highway Transportation Leads Nation By 3 to 1 In Total Passenger Miles

HIGHWAY transportation in the United States has credited to it a world's record of over three times as many passenger miles as all other forms of transportation combined, according to a tally recently published by a well-known firm of engineer consultants in New York.

Forms of transportation surveyed included steam and electric railways, domestic air lines, inland waterways including Great Lakes traffic, as well as all forms of highway transportation.

In 1945 highway transportation alone accounted for the astronomical total of 491,995,000,000 passenger-miles. Of this total passenger cars piled up 429,100,000,000 passenger-miles and buses accounted for 62,895,000,000 passenger-miles; this latter figure was exceeded only by the railroads with a total of 91,000,000,000 revenue passenger-miles. Also noted in the survey was the fact that truck transport accounted for an estimated total of 48,800,000,000 ton-miles of freight moved.

Over the past 25 years private automobiles have increased from about 60,000,000,000 passenger-miles to the 1945 figure of 429,100,000,000 passenger-miles. Buses since 1923 have increased from 4,000,000,000 passenger-miles to 62,895,000,000 passenger-miles.

Fourteen Miles of Three Flags Highway Has Been Resurfaced

By LUIS ARAMAYO, Resident Engineer

RESURFACING of a 14-mile section of the Three Flags Highway, on State Route 73, between Viewland and Secret Valley has been completed.

The initial stage construction in 1936 included grading, drainage, and a base of imported borrow, with penetration oiling. In 1941 a light road-mix was placed. The resurface consists of a gravel base cushion course over a portion of the existing highway across Mud Lake, and covering this and the remainder of the section with two inches of plant-mixed surfacing and a Class "A" seal coat.

Of historical interest is the fact that the highway follows the route of the old wagon road built in 1869 across Mud Lake, near the site of the burning by the Piute Indians, in 1862, of the Mud Flat Station enroute to the old Humboldt Mines.

This portion of the highway is located in Lassen County, which is situated in the Cascade Range at the northern end of the Sierra Nevadas. Lassen is one of the larger California counties and was created in 1864 from parts of Plumas and Shasta Counties. The county is mountainous throughout, with a minimum elevation of nearly 4,000 feet, high plateaus, and numerous peaks that exceed 7,000 feet in altitude.

GEOLOGICAL FEATURES

Complex geological activities associated with the formation of the Sierra Nevada and Cascade Ranges and the formation and dessication of ancient Lake Lahonaton produced the present physiographic features of this area. The present formations are mainly of lacustrine or semilacustrine nature consisting of old lake bottoms and terraces. On the north the valley is bounded by the low barren hills of the lava plateau, which extends into Northern California and Oregon.

The two-mile strip across Mud Lake consists of a fill approximately five feet high which has, in the past, given considerable trouble by developing longitudinal cracks and fissures extending the depth of the fill and, in many instances, several hundred feet in length. This is caused by drying up of the lake bottom during the summer months. Several attempts were made to correct this by raising the grade of the fill, with no permanent success. On the project just completed a cushion course 0.33 feet thick of imported gravel base has been placed on top of the existing pavement for the purpose of dissipating any stresses that may originate in the future, thus preventing them from damaging the newly laid plant-mixed surfacing.

North end of 9.6-mile tangent looking toward Secret Valley. Secret Valley Maintenance Station in left background





Near Viewland, looking south. Dry bed of Honey Lake, remnant of ancient Lake Lahonatan in dim background

WATER PHENOMENA

Parts of the existing subgrade, particularly on the summit near Viewland, were greatly deteriorated and had to be removed and replaced with imported borrow. It is interesting to note that this subgrade material, approximately 12 inches thick and clayish in nature, laying between the old oiled earth surface, which was rather well preserved, and the existing pavement, was found to be completely saturated with water with no visible or apparent seepage of water anywhere.

The work was done during one of the hottest summer seasons experienced in this part of the desert, and the material beneath the old surface was relatively dry. Whether the existing subgrade material is hygroscopic is a matter of conjecture.

(Continued on page 32)

Oiled earth road beyond long tangent. Portion of 17-mile bottleneck, Secret Valley to Ravendale



North Sacramento Freeway Project Construction Is Well Advanced

By ARTHUR L. ELLIOTT, Associate Bridge Engineer

THE North Sacramento Freeway project, by-passing the heavy Route 3 (US 40 and 99E) traffic around the increasingly congested business district of North Sacramento, is now one-third complete.

Starting near the east end of the North Sacramento Viaduct, the new alignment runs 4.1 miles with only two changes of direction to return to the present traveled highway near the Municipal Golf Course about one-half mile east of the Ben Ali Underpass.

The new highway is a full freeway, four lanes with a 30-foot division strip. Access is allowed at only seven locations in this length. Intersecting streets which are not to be closed are taken either over or under the freeway with partially developed, modified clover-leaf type connections being provided.

Owing to the fact that the land adjacent to most of the freeway is relatively undeveloped, only the two opposite corners of the normally four-section clover-leaf are being provided in this contract. The right of way has been obtained for the remaining two quadrants however, so that the full intersection may be completed when the traffic warrants.

EIGHT STRUCTURES

The cost of the construction portion of the project is about $1,800,000, nearly equally divided between the grading and the eight structures which include an underpass under the main line of the Southern Pacific Railroad.

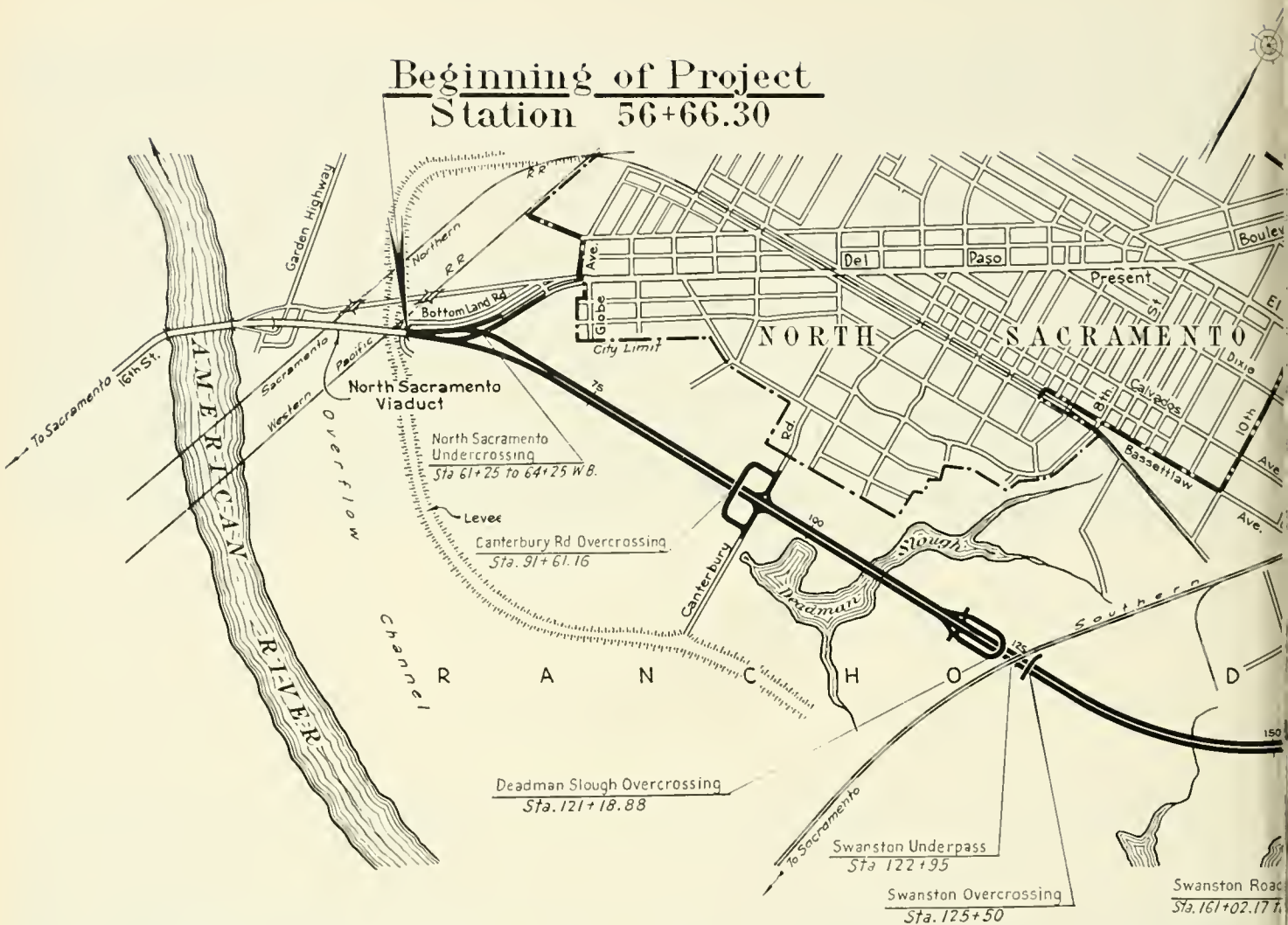
At the present time the grade has all been roughed out and most of the 16-inch minimum blanket of river sand being used as select material has been placed. The typical section for the freeway calls for an RC-3 bituminous surface treatment of the top four inches of the select material under the eight-inch uniform thickness Portland cement concrete pavement. This surface treatment is being done at the present time.

It is hoped that paving operations will be started before the winter rains commence with the possibility that a dry winter will enable the contractor to complete most of the paving without a winter shut-down.

All of the structures are under way in various stages. The North Sacramento Undercrossing, which provides a connection to and from North Sacramento at the west end of the freeway, has the footings and columns completed

Looking west over North Sacramento Undercrossing toward the viaduct. Traffic from North Sacramento will come up from the right, joining traffic from the freeway over the new structure. Traffic going east will enter under the freeway to the left; traffic to North Sacramento will cross under the structure





Plan and profile of North Sacramento Freeway between the North Sacram

and the girder forms are being erected rapidly. This structure is being pushed during this season because as a detour for west-bound traffic, the old State Highway across the bottom land replaced by the viaduct in 1942, is being used.

ROAD MAY BE CLOSED

It is possible that this old road may be closed by flood waters as early as December first. By that time it is expected that all connections in this area will be paved and the undercrossing sufficiently completed so that traffic in both directions will again be on the Viaduct and up out of flood danger.

Of the eight structures, six are of the concrete hollow box girder type, one is variable thickness slab construction, and the railroad structure is steel plate girders on steel columns. All of the structures have steel railings.

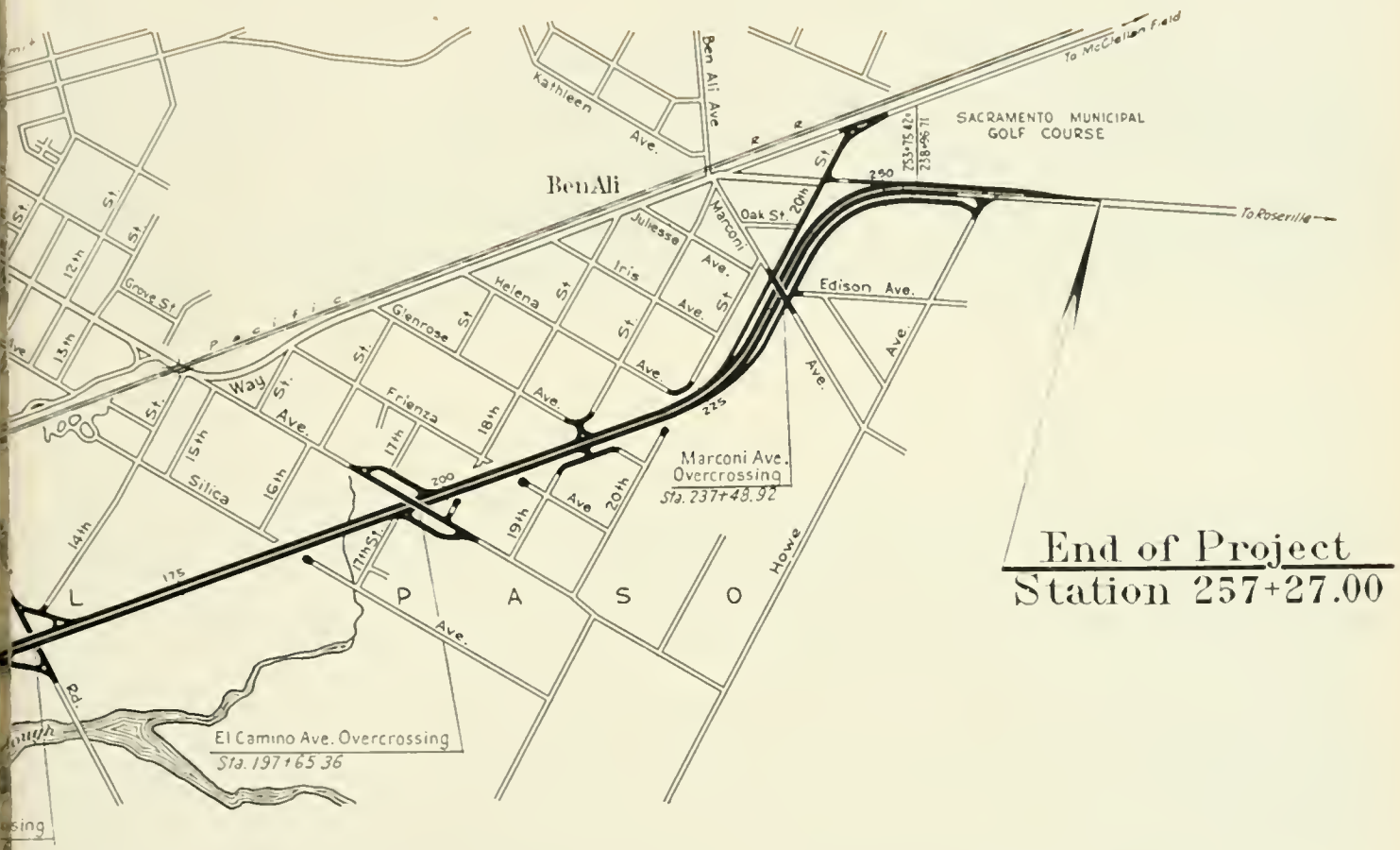
The separation structure at Canterbury Road over the freeway is virtually complete except for the railing and end posts. A portion of the approach fills has been placed and has still to be surfaced. The arrangement of this structure is a case where the bridge was offset parallel to the existing cross-street and new right of way obtained. The existing street will be used for inlet and outlet from the freeway. In addition, in the parallel position, the bridge is intended to line up with a main street in a projected subdivision of the undeveloped land south of the freeway.

The direction-change and access structure near Deadman Slough is having the last deck pours made, leaving it complete except for the curb and railing.

SHORTAGE OF STEEL

The Swanston Underpass under the Southern Pacific tracks necessitated one of the two major excavations on the project. This excavation, over which three structures are being built, is complete except for the removal of the railroad shoo-fly fill. These three structures adjacent to the railroad are all on pile foundations. The footings and abutments of the Underpass structure are completed but further construction is stymied waiting for structural steel.

Postponed rolling dates at the steel mills in the East caused the first delay and then the shipment of steel by water to the West Coast had the further mis-



Viaduct and one-half mile east of Ben Ali. Project is one-third completed

fortune of getting caught at sea during the maritime strike, causing several weeks additional delay. This delay is vital to many parts of the work in this area because, until the railroad can be restored to its permanent alignment on the new structure, the shoo-fly fill, on which the trains are now operating, blocks the freeway section, dividing it into two parts and holding up grading and paving operations on about 4,000 feet of the freeway.

SWANSTON OVERCROSSING

The Swanston Overcrossing structure, to provide a cross-over to the undeveloped property between the freeway and the American River, is also complete except for the curbs and railing. Limited approaches have yet to be provided.

The Swanston Road Undercrossing structure has only the approach fills and the footings completed. This bridge, 109 feet wide to accommodate speed change lanes, in fact wider than it is long, will be uniform depth slab construction carrying both lanes of the freeway with the outer lanes and the center dividing strip over Swanston Road.

The El Camino Avenue Overcrossing structure provides a separation with connections for El Camino Avenue. The approach fills and the main footings have been placed.

At Nineteenth Street and Glenrose Avenue side access but no cross-over is provided. The two streets are joined in loop connections on each side outside the right of way, and side access provided to these loops. Twentieth Street and Helena Avenue, which would otherwise be dead-end streets, are looped together outside the right of way to eliminate the cul-de-sac.

MARCONI AVENUE OVERCROSSING

At the Marconi Avenue Overcrossing the freeway dips into a long depressed section to go under Marconi Avenue and a portion of Edison Avenue. This is the largest single excavation on the project and material from this cut was distributed over much of the job. Having completed the excavation and subgrading, the sand borrow has been placed and given the bituminous surface treatment through this area. Excavation for the footings of the retaining walls which line the freeway through this depressed section, is now under way.



Depressed section under Marconi Avenue structure, which is not yet under construction

In this area the adjacent property is more developed than at any other location along the freeway. By the use of retaining walls, the width of right of way needed to accommodate the slopes is materially reduced. Construction economies were also achieved and abutting property was accommodated by constructing the outer highway at average ground level above the elevation of the freeway. This arrangement provides much more ready access to and from the freeway for the adjoining property.

FUTURE LANDSCAPING

One feature of the two structures over the depressed sections, in addition to the pairs of large pumps provided to remove run-off water, will be the provision of deep-well pumping plants for future irrigation of roadside landscaping. These 10-inch wells are to be provided with 200-gallon per minute pumps to supply plenty of water for a planned sprinkler system in the future landscaping scheme. In other areas along the freeway, topsoil has been stockpiled and will be placed upon the slopes. Areas in the center division strip where the cuts have been less than one foot below natural ground will be scarified to facilitate future landscaping.

The division strip on the project is in general unkerbed although in access

(Continued on page 31)

Looking eastward along the freeway with the Canterbury Road overcrossing in foreground and Deadman Slough structure in distance



Limited Access Postwar Project In District X Nearing Completion

By MARC C. FOSGATE, District Construction Engineer

ANOTHER postwar project in District X, Division of Highways, which is nearing completion, will be of particular interest to the travelers on this route who were required to detour when the highway was submerged by San Joaquin River floods.



New bridge at Paradise overflow to replace present span on right is shown under construction

This improvement is located in San Joaquin County between the Grant Line Road intersection with the U. S. Route 50 east of Tracy and the Mossdale intersection of U. S. Route 50 with California State Highway Sign Route 120, a distance of about 3.8 miles.

The road carries most of the traffic originating in the Bay region with a destination in San Joaquin Valley or traveling the inland routes south, and may also be considered a farm-to-market road in that it carries products from the San Joaquin Valley as far south as Bakersfield and into the Bay area. The route traverses the Altamont Pass which is the most important artery between the Pacheco Pass in Merced County and the Sacramento River. The present average daily traffic is 8,400, and reaches a peak of over 12,000.

FLOODS CLOSE HIGHWAY

The section of road now being improved was closed to traffic on account of floods, for a total of 27 days from March 16th to March 26th, and from June 7th to June 24th in 1938. Between these dates, the traffic between Tracy and Stockton was detoured across Roberts Island to California State Highway Sign Route 4. The traffic between Tracy and Manteca was detoured through San Joaquin City and back to the highway on the Durham Ferry Road. During this period of time, it is estimated that an additional 2,000,000 car miles over lower type roads was expended by traffic.

The immediate improvement consists in general of the construction of an additional two lanes of Portland cement concrete pavement along the southwesterly side of the existing pavement which, with a separation strip, will provide a divided highway as a part of a limited freeway. The new pavement is designed at an elevation above anticipated high water.

Two bridges are included in the project, one crossing the Paradise Cut relief channel and the other, over the



This sort of congestion will be relieved by new highway shown on elevation at right. View is on east end of project with traffic approaching Mossdale Bridge. A second bridge will be built for east-bound traffic

San Joaquin River overflow channel. A new bridge over the San Joaquin River at the Mossdale intersection is planned but has not been advertised because of the shortage of materials, especially structural steel.

TO BUILD NEW BRIDGE

It is anticipated that this bridge will be constructed under two contracts, the first of which is to be advertised in the near future and will consist of the foundation construction and the second, for the super-structure, will be advertised as soon as it has been determined that the materials are available. A temporary connection southwest of the San Joaquin River will permit the use of the divided highway until the new bridge is constructed.

The Portland cement concrete pavement which is 8 inches in thickness and 23 feet wide is being constructed in two lanes, the right hand lane being 11 feet wide with the passing lane 12 feet in width. The two lanes are being tied together with tie bolt assemblies. There are no expansion joints but dummy joints to control contraction have been placed at 15-foot intervals. The pavement is laid over a 0.5-foot compacted thickness of untreated rock base. Plant-mixed surfacing laid on untreated rock base is used for the transition from four lanes to two lanes at each end of the project.

HANDY IMPORTED BORROW

Imported borrow for embankment construction was obtained from a draw in Paradise Cut, where sandy material was available. It was hauled to the road in Tournapulls. This borrow location was approximately at the center of the job and adjacent to the existing highway on the northwest side. This material was specified for embankment construction beneath an elevation 2½ feet below profile grade. Above this elevation, a higher quality borrow was required, the important specifications for which are minimum bearing value at 0.1-inch penetration after soaking, 20 per cent, expansion of not more than 1.0 per cent, and a plasticity index of not more than 6 per cent. This material was obtained from a location about 0.5 of a mile east of the northeast end of the project and was all transported in trucks across the San Joaquin River Bridge.

The untreated rock base was a commercial product supplied by the Pacific Coast Aggregates Company plant at River Rock. The mineral aggregate and concrete aggregate, also obtained from this plant were hauled to the roadbed or batching plant by trucks. The large size aggregate for the concrete pavement was obtained from the Elliott plant near Livermore and shipped by rail to the project. A Nobel full automatic batching plant was used for the Portland cement concrete pavement.

Also included in the current contract is the construction of a modern design highway intersection at the junction of U. S. Highway 50 and the California State Highway Sign Route 120 at the northeast end of the project, east of the San Joaquin River and south of the Mossdale railroad underpass.

The construction of the concrete pavement has been completed and it is anticipated that traffic can be routed over the new construction early in November.

The cost of this construction will be approximately $400,000. The contractor is the M.J.B. Construction Company of Stockton. The Resident Engineer is E. L. Crann.

Traffic on State Highways Shows 46.5 Per Cent Increase Over 1945

By G. T. McCOY, State Highway Engineer

THE annual state-wide traffic count taken on Sunday and Monday, July 14th and 15th, shows the very marked upturn in traffic which has occurred since the cessation of hostilities and the removal of restrictions on the use of motor vehicles. Comparison with the annual count of July, 1945, which was taken a month prior to the ending of gasoline rationing, reveals an increase of 46.5 per cent. This is likewise an increase of approximately 18 per cent over the previous high annual count of July, 1941.

These increases were general throughout the entire system. All routes without exception recorded gains; and while among the various route groups the Recreational group shows the largest percentage gain, this increase is only slightly greater than that of others. Since the wartime restrictions on the operation of commercial vehicles were much less drastic than those imposed upon passenger vehicles, the present increase in traffic is in very large measure accounted for by the greater use of passenger cars, commercial vehicle traffic showing only a nominal gain.

No change was made from the regular procedure of previous years in the manner of taking the count. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday, totals being shown for each hour. Traffic is segregated into the following vehicle classifications: California passenger cars, out-of-state passenger cars, buses, pickups, two-axle commercial units, three-axle units, four-axle units, five-axle units, and six-or-more-axle units.

Each year some minor changes in the census become necessary, such as the relocation, addition, or discontinuance of individual stations; but in every instance these are excluded when determining comparison with the preceding year, only those stations that were identical during both years being taken into consideration.

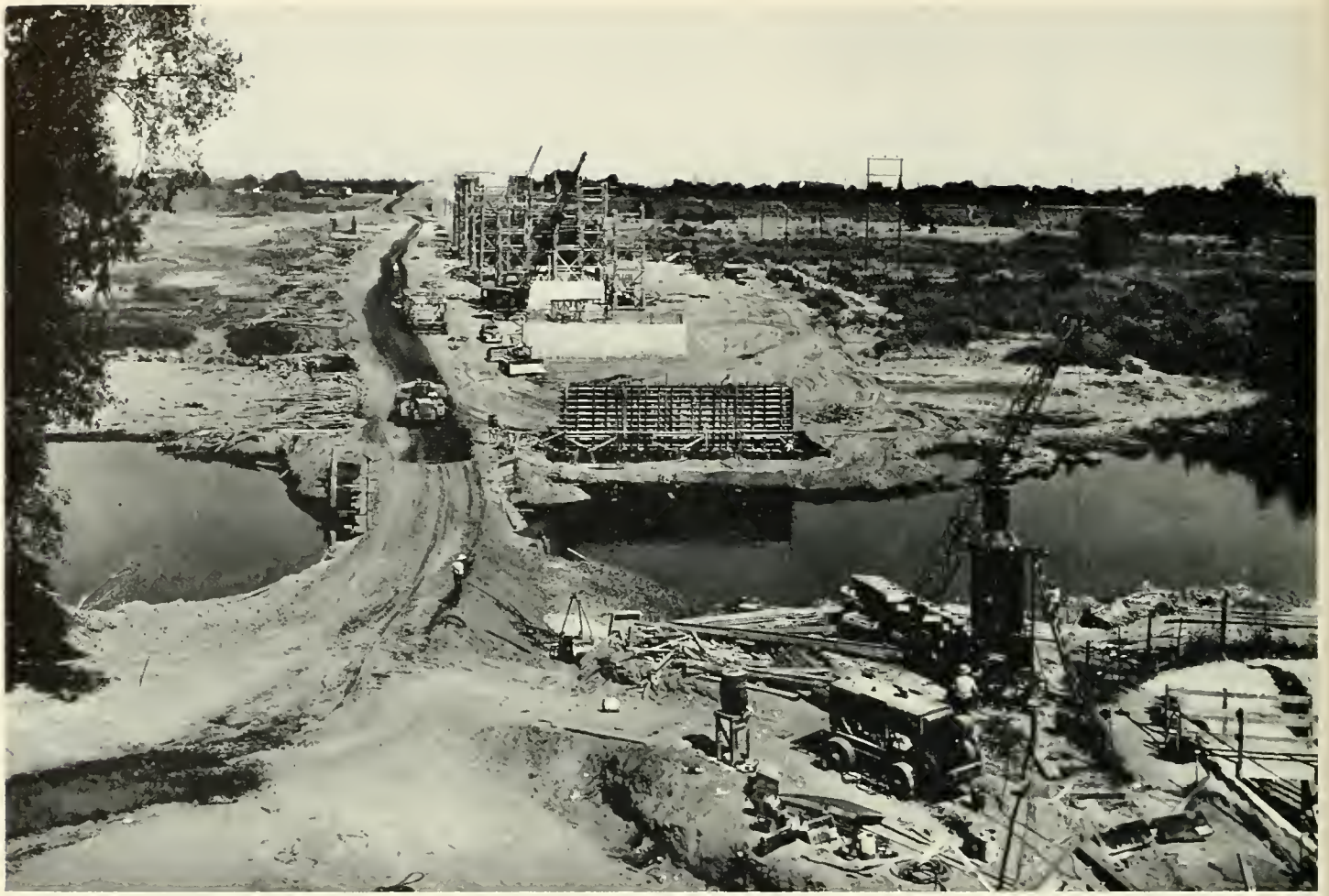
These comparisons for the various route groups are as follows:

PER CENT GAIN OR LOSS FOR 1946 COUNT AS COMPARED WITH 1945

	Sunday	Monday
All routes	+ 46.10	+ 46.55
Main north and south routes	+ 47.28	+ 50.00
Interstate Connections	+ 53.73	+ 45.76
Laterals between inland and coast	+ 41.82	+ 40.52
Recreational routes	+ 53.18	+ 51.74

The gain or loss of traffic volume for State Highway Routes 1 to 80, inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation.

Route	Termini	1946 Per cent gain or loss Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
1.	Sausalito-Oregon Line	67.03		74 16	
2.	Mexico Line-San Francisco	26.99		42.34	
3.	Sacramento-Oregon Line	7S.85		68.86	
4.	Los Angeles-Sacramento	69.S1		48.56	
5.	Santa Cruz-Jc. Rt. 65 near Mokelumne Hill	48.52		37.74	
6.	Napa-Sacramento via Winters	49.54		S5.76	
7.	Crockett-Red Bluff	71.74		72.S7	
8.	Ignacio-Cordelia via Napa	S7.S1		S6.94	
9.	Rt. 2 near Montalvo-San Bernardino	48.43		47.76	
10.	Rt. 2 at San Lucas-Sequoia National Park	S3.76		37.72	
11.	Rt. 75 near Antioch-Nevada Line via Placerville	73.42		49.19	
12.	San Diego-El Centro	39.47		29.82	
13.	Rt. 4 at Salida-Rt. 23 at Sonora Jc.	29.S4		S6.23	
14.	Albany-Martinez	43.33		S1.86	
15.	Rt. 1 near Calpella-Rt. 37 near Cisco	70.S7		61.18	
16.	Hopland-Lakeport	S5.30		37.26	
17.	Rt. 3 at Roseville-Rt. 15. Nevada City	59.77		S5.06	
18.	Rt. 4 at Merced-Yosemite National Park	124 03		121 60	
19.	Rt. 2 at Fullerton-Rt. 26 at Beaumont	3S.01		36.11	
20.	Rt. 1 near Arcata-Rt. 83 at Park Boundary	74.04		71.08	
21.	Rt. 3 near Richvale-Rt. 29 near Chilcoot via Quincy	87.8C		73.39	
22.	Rt. 56, Castroville-Rt. 29 via Hollister	22 99		26.S8	
23.	Rt. 4 at Tunnel Sta.-Rt. 11, Alpine Jc.	39.59		4S.10	
24	Rt. 4 near Lodi-Nevada State Line	63.18		S1 92	
25.	Rt. 37 at Colfax-Rt. 83 near Sattley	72.3S		92.16	
26.	Los Angeles-Mexico via San Bernardino	28.38		34 53	
27.	El Centro-Yuma	0.02		0.07	
28.	Redding-Nevada Line via Alturas	63.14		46.49	
29.	Peanut-Nevada Line near Purdy's	S4.40		4S.76	
31	Colton-Nevada State Line	4S.BS		37.80	
32.	Rt. 56, Watsonville-Rt. 4 near Califa	62.61		63.42	
33.	Rt. 56 near Cambria-Rt. 4 near Famoso	32.22		28.75	
34.	Rt. 4 at Galt-Rt 23 at Pickett's Jc.	60.S1		52.06	
3S.	Rt. 1 at Alton-Rt. 20 at Douglas City	64 09		72.07	
37.	Auburn-Truckee	83.86		104 14	
38.	Rt. 11 at Mays-Nevada Line via Truckee River	9S 76		106.29	
39.	Rt. 38 at Tahoe City-Nevada State Line	80.34		73.36	
40.	Rt. 13 near Montezuma-Rt. 76 at Benton	83.06		127.78	
41.	Rt. 5 near Tracy-Kings River Canyon via Fresno	49.S7		38.01	
42.	Redwood Park-Los Gatos	78.69		67.47	
43.	Rt. 60 at Newport Beach-Rt. 31 near Victorville	31.90		34 02	
44.	Boulder Creek-Redwood Park	69.01		23.14	
45.	Rt. 7, Willows-Rt. 3 near Biggs	S0.S7		20.21	
46.	Rt. 1 near Klamath-Rt. 3 near Bray	78.27		77.38	
47.	Rt. 7, Orland-Rt. 29 near Morgan	56.90		48.S1	
48.	Rt. 1 N. of Cloverdale-Rt. 56 near Albion	46.S9		62.77	
49.	Napa-Rt. 1S near Sweet Hollow Summit	49.70		44.23	
S0.	Sacramento-Rt. 1S near Wilbur Springs	74 72		72.20	
S1.	Rt. 8 at Shellville-Sebastopol	37.3S		29.S2	
S2.	Alto-Tiburon	S0.S4		S4 97	
S3.	Rt. 7 at Fairfield-Rt. 4 near Lodi via Rio Vista	43.93		39.S0	
S4.	Rt. 11 at Perkins-Rt. 6S at Central House	120.43		47 4S	
S5.	Rt. S near Glenwood-San Francisco	102.1S		139.2S	
S6.	Rt. 2 at Las Cruces-Rt. 1 near Fernbridge	S6.96		44 31	
57.	Rt. 2 near Santa Maria-Rt. 23 near Freeman via Bakersfield	49.S0		31.83	
58.	Rt. 2 near Santa Margarita-Arizona Line near Topock via Mojave and Barstow	28.93		42 71	
S9.	Rt. 4 at Gorman-Rt. 43 at Lake Arrowhead	37.41		46.S1	
60	Rt. 2 at Serra-Rt. 2 at El Rio	46.28		45.40	
61.	Rt. 4 S. of Glendale-Rt. S9 near Phelan	S8.22		38.80	
62.	Rt. 171 at Northam-Rt. 61 near Crystal Lake	48 69		26.3S	
63.	Big Pine-Nevada State Line	0.0S		42.18	
64.	Rt. 2 at San Juan Capistrano-Blythe	42.0S		4S.92	
65	Rt. 18 near Mariposa-Auburn	62.19		71.74	
66.	Rt. 5 near Mossdale-Rt. 13 near Oakdale	109.S1		33.7S	
67.	Pajaro River-Rt. 2 near San Benito River Bridge	33.9S		21.84	
68.	San Jose-San Francisco	S1 31		52.43	
69.	Rt. S at Warm Springs-Rt. 1. San Rafael	3S.94		4S.61	
70.	Ukiah-Talmage	33 07		28.10	
71.	Crescent City-Oregon Line	1S8.4B		166.74	
72.	Weed-Oregon Line	156.38		201 73	
73.	Rt. 29 near Johnstonville-Oregon Line	4S.SS		S4.44	
74.	Napa Wye-Cordelia via Vallejo and Benicia	32 78		33.23	
7S.	Oakland-Jc. Rt. 6S at Altaville	47.S2		34 74	
76.	Rt 12S at Shaw Ave.-Nevada State Line near Benton	38 76		52.10	
77.	San Diego-Los Angeles via Pomona	3S.74		27 22	
78.	Rt. 12 near Descanso-Rt. 19 near Marsh Field	36.29		19.78	
79.	Rt. 2, Ventura-Rt. 4 at Castaic	59.61		29.78	
80.	Rt. 51, Rincon Creek-Rt. 2 near Zaca	S4 65		53.66	



Pier construction for Feather River Bridge. Looking along the structure toward Marysville from the Yuba City levee. The summer flow of the Feather River, all but depleted by diversion for irrigation, is crossed by a temporary construction bridge in the foreground

Peach Bowl Laced by New Bridge

By RALPH W. HUTCHINSON, Associate Bridge Engineer

BETWEEN Marysville and Yuba City, in the Peach Bowl of America, the new bridge across the Feather River is nearing completion. All of the abutments and piers are in place and waiting for the arrival of the structural steel which has been delayed by the maritime strike.

The new bridge will divert through traffic from the 40-year-old bridge, five blocks downstream, which has long been inadequate for the traffic which was required to use it. In addition to the local traffic between the two interdependent communities of Marysville and Yuba City the bridge is a focal point for east and west traffic across the Sacramento Valley as well as for north and south traffic on the East Side Highway, U. S. 99E. By 1941 about 18,000 vehicles daily crossed the existing bridge on the 19-foot-wide "wagon road," as it was designated on the 1906 bridge plans.

OBSOLETE SPAN REPLACED

The replacement of the obsolete bridge has been under consideration over a period of years and was delayed by the war. Early studies made it apparent that any satisfactory solution of the problem required that traffic be removed from the main business streets of the two cities. Replacement of the existing bridge at the same location with a structure designed to modern standards was almost an impossibility due to the controlling features of levees, railroad tracks and highly developed business property adjacent to the site. On new alignment there was less restriction and the bridge could be built better, cheaper and with less disruption of the existing business life of the two cities. The old bridge could be left in place to continue to serve for the rest of its economical life.

Several years were required to bring together the various interested parties and agree upon a location. Design of the bridge was begun in 1941 and construction was scheduled to start in 1942. Actual construction was a war casualty. Construction of this bridge was considered so urgent that during the early part of the war plans were prepared for the construction of the

concrete piers, using salvaged railroad rails for reinforcing, so that the bridge could be completed with minimum delay as soon as structural steel became available. Before this plan could be contracted the shortage of labor and materials became so critical that the project was deferred and the Feather River Bridge became a postwar project with top priority.

FOUR-LANE DIVIDED HIGHWAY

As soon as materials and equipment became available a contract for the construction of the span was awarded. Work began in January of 1946. Work being done under the bridge contract consists of the Feather River Bridge, the Yuba City Overhead over the tracks of the Southern Pacific Railroad, the Sutter Street Undercrossing over Sutter Street in Yuba City and about 2,000 feet of approach fills. The extent of the contract is about 0.9 mile. The cost of work being done is $1,879,000. Additional contracts are underway for widening and improving connecting streets in Marysville and in Yuba City. When completed the entire project will provide a four-lane divided highway having limited access to side streets and adjacent property. Five-foot-wide sidewalks will be provided for pedestrians.

The major feature of this project is the bridge across the Feather River costing about $1,678,000. Of less magnitude are the Yuba City Overhead costing about $73,000 and the Sutter Street Overhead costing about $44,000.

The Yuba City Overhead carries the approach highway over the tracks of the Southern Pacific Railroad at the foot of the levee on the west side of the Feather River. It consists of a reinforced concrete barrel 118 feet long with wing walls. The barrel is 20 feet wide and 23 feet high over the tracks. There is about seven feet of highway fill over the barrel. The entire structure is supported by steel H piles.

SUTTER STREET UNDERCROSSING

The Sutter Street Undercrossing carries the approach highway over Sutter Street in Yuba City. With connecting ramps it will provide convenient access directly into Yuba City from the highway. A 26-foot wide roadway and two 4-foot wide sidewalks are provided on Sutter Street. The structure is a flat slab reinforced concrete design. It has three spans, a 36-foot span over Sutter Street and two side spans, 24 feet long, connecting to the approach fills with small abutments and short wings. The deck slab is carried on concrete columns and below ground the entire structure is supported by steel H piles.

The Feather River, in the vicinity of Marysville, is confined by levees which are about 25 feet high at the bridge site. The bridge extends from levee to levee, a distance of 2,674 feet. The bridge also serves as a grade separation structure for it passes over the main line tracks of the Western Pacific Railroad which run along the top of the levee on the east side of the river. In order to provide the necessary clearance over the tracks the high point of the bridge is more than 60 feet above the river bed. The entire structure is on graceful vertical curves which connect to the approach fills. The fills have a maximum height of about 50 feet.

The bridge consists of 24 spans. Most of these are 115 feet long but longer spans up to 161 feet long are

Completed piers for Feather River Bridge. Looking toward Yuba City from the Marysville end. The first of 23 piers rise from the river bed ready for the structural steel girders





Compacting original ground prior to placing imported borrow on realigned approach to new Feather River Bridge. Scene is at Fifth and E Streets in Marysville

used across the main channel of the river while over the railroad tracks shorter spans down to 69 feet long are used in order to keep the bridge grade to a minimum. Alternate spans are anchor spans with cantilevers which carry 72-foot suspended girders in the adjacent spans.

The deck is carried on a pair of plate girders which are 10 feet deep over most of the bridge but are haunched to 12 feet 6 inches at the longer spans and tapered to 6 feet deep over the tracks. These are the largest highway plate girders used by the Bridge Department. The girders carry cantilevered floor beams at 23-foot intervals which support steel stringers and a concrete deck.

The bridge provides for two roadways 25 feet wide, separated by a four-foot dividing strip. There is a five-foot sidewalk on each side with a steel railing on the outside. The bridge is lighted by luminaries suspended from standards set in the railing along the sidewalk. All of this is in contrast to the narrow roadway, tight clearance to trusses and crooked approaches on the existing bridge route.

One of the features of the bridge are the concrete piers. Owing to the necessarily great height of these piers particular attention was given to the design. One of the factors influencing the choice of two main girders and a cantilevered deck was the advantage gained by shortening the length of the piers so as to minimize the cost and weight.

The violence of the river and the heavy drift carried during the larger floods prevented the use of open column bents or towers. Above high water the girders are supported on pylons of variable height. The junction between the pylons and the main pier shaft is on a vertical curve similar to that of the roadway. The main shafts are of cellular construction to reduce the weight and cost. The noses of the piers are streamlined by means of elliptical curves. The elliptical curves are compounded with a graceful curve extending the whole length of the shaft. Making the entire shaft on a curve reduced the possibility of a harsh transition between a curved nose and a straight shaft.

Eight of the piers near the east end are supported on spread footings founded on hardpan about 10 feet below the ground line. The remainder of the piers and the abutments are supported on steel H piles.

The piers were designed to make possible the multiple use of concrete forms. The same forms were reused for any pier regardless of height by constructing the forms in units or lifts. Offsets were provided in the pier design to conceal the variations in dimensions caused by varying the height of the battered units.

The structural steel was designed for economical production. Details were standardized and designed for ordinary shop fabrication. Except for minor variations, due to the vertical curvature, the same units were used throughout most of the structure.

In the design considerable attention was given to achieving a pleasing appearance. This was accomplished by careful proportioning of the required structural materials rather than by adding excess materials to create an architectural effect.

The structures on the project were designed by the Bridge Department and the approaches by the District Office, Division of Highways in Marysville. Construction is being handled by the Bridge Department. Harry Carter is the Resident Engineer. The contractor is J. H. Pomeroy Inc. of San Francisco.

U. S. 99E Project Through Marysville and Yuba City Is Extensive Undertaking

By P. C. SHERIDAN, Associate Highway Engineer

IN connection with the bridge now under construction across the Feather River, between Marysville and Yuba City, a separate contract is under way for construction of approaches in both cities.

The approach work is quite extensive, involving the grading and paving of about two miles of streets and immediate approaches.

The existing route through Marysville traverses "D" Street at Fifth Street, with curb to curb widths of 56 feet to 69 feet, allowing for two lanes of traffic and room for diagonal parking.

The approach to the existing bridge in Yuba City is on very poor alignment. There are reverse right angle turns to negotiate the overpass grade separation of the Sacramento Northern Railroad.

The 1946 traffic count taken on the Feather River Bridge between Marysville and Yuba City on Monday, July 15th, for a 10-hour period, was 22,617 vehicles of which approximately 20 per cent were trucks. The peak hour count was 1,955 vehicles. At periods of heavy traffic volume there is much congestion.

The new location begins at the north end of the "D" Street Bridge at the southerly approach to Marysville, angles across to "E" Street by a new connection, traverses "E" Street and Tenth Street in Marysville, crosses the Feather River and extends by way of Sumner and Colusa Streets to the end of the project at the junction of Routes 3 and 15 near the north city limit of Yuba City.

Generally, four 12-foot lanes and, where necessary, 8-foot parking lanes are being provided. The opposing lanes are to be divided except from Second Street to Sixth Street in Marysville and from Plumas Street to the end of the project in Yuba City.

A grade separation with "off" and "on" ramps will be constructed to serve the southeastern portion of Yuba City by way of Sutter Street, and outer highways are being provided to connect the channelization at the Sutter Street Undercrossing with the existing streets from Sutter Street to Plumas Street.

Street intersections are being channelized at First Street, Tenth and E Streets in Marysville, at Plumas Street and at Live Oak Road in Yuba City.

A crossing of the Yuba City Branch of the S. P. is effected by an overhead.

Sixteen inches of imported borrow is to be placed superimposed with cement treated base and asphalt concrete pavement.

The work is being done in sections. It is specified that no two adjacent sections shall be opened up at one time to minimize inconvenience to traffic. Not more than three consecutive cross streets are closed at one time.

Considerable adjustments to domestic water lines, communication systems, power lines, and storm and sanitary sewer lines were necessary to accommodate the improvement.

The plans were prepared as a post-war project and a contract was awarded to Lester L. Rice on June 22, 1946 at a construction cost of $680,000. Two hundred working days are allowed to complete the project which should make the improvement, with the new Feather River Bridge, available for public traffic early next summer.

The work is under the general supervision of C. H. Whitmore, District Engineer, District III, with F. D. Hillebrand as Resident Engineer.



Route of proposed State highway in Yuba and Sutter counties between D Street Bridge in Marysville and Route 15 in Yuba City



Cement treated base on Rosemead Boulevard had been completed on roadway to the right and seal coat applied when this construction picture was taken

Rosemead Boulevard Job Completed

North end of project at El Dorado Street a few blocks east of Pasadena City limits



A RECENTLY completed one-mile section of Rosemead Boulevard easterly of Pasadena reflects the latest trends in the use of cement-treated soils and bases in highway design.

On this project two types of cement treatment were used.

First, four inches of native soil was treated in place by the road-mix method.

Second, four inches of imported material was treated with cement at a central mixing plant.

The final surface was four inches of asphaltic concrete. The total thickness, therefore, amounts to 12 inches. As the native soil has excellent supporting

Pictures on opposite page show, upper—Mixing cement treated subbase on Rosemead Boulevard. Lower—Close-up of equipment used in mixing cement-treated subbase





qualities, a pavement structure of unusual strength was developed.

The subbase treatment was made with a traveling mixer which completed the operation in a single pass. The earth to be treated was first bladed into windrows upon which the cement was distributed in measured amounts, approximately 5½ per cent by weight. Water was added through the mixing machine. Immediately after completion of the mixing operation, the material was shaped to section with motor graders, and compacted with a 12-ton tandem roller and a 6-ton pneumatic-tired roller. An emulsion curing seal was applied upon completion of the rolling.

The imported material for the second course was mixed with cement and water in a central mixing plant, for which a standard asphaltic plant was used. The mixture was spread on the street with the conventional type asphalt machine.

Compaction was obtained with the same two rollers mentioned above; and also, the same type of curing seal was used. Six and one-half per cent cement was used in treating the imported base material. Compressive strength developed in the base, as indicated by test specimens, was unusually high for the small percentage of cement used.

Rosemead Boulevard is the local name for the northerly portion of Route 168, extending from Long Beach to Pasadena, with termini at the easterly edges of the two cities. It was originally located to by-pass all urban areas but war plants and housing projects and, now, the rapid expansion of the Los Angeles Metropolitan Area is changing the character of this route from a country highway to a city street. Traffic increase has been phenomenal.

This latest section to be improved, from Huntington Drive to Colorado Street, consists of two 32-foot paved roadways separated by a 28-foot median strip. At some later date when necessity demands, two additional 12-foot traffic lanes may be constructed by narrowing the center parkway.







Upper—View of completed project, looking north from center of Huntington Drive. Center—Openings in central parking strip are located for safety rather than convenience at side streets and are spaced at a minimum of 700 feet. Lower—Completed boulevard near center of project. Central dividing strip may be reduced from 28 feet to 4 feet to provide an additional 12-foot lane in each roadway when needed

Reduction of Fire Hazards Along California State Highways

(Continued from page 7)

spraying and burning on cuts and fills and discing or blading on the wide flat spaces between.

The determining of the desired method of control is governed by the width of the shoulder and right of way, the location of the gutter line, the nature of the soil, and the profile of the treated roadside.

A new method of establishing a fire hazard control strip along the roadside, which is expected to greatly reduce costs over the conventional spray and burn system, has been given a trial this year. This method uses an inexpensive machine which consists essentially of a blower, powered by a small air-cooled engine, and a movable extended arm to which a burner head is attached. This machine is mounted on a two-wheel trailer which carries tanks for fuel oil which is used for heat. An intense flame is directed over a strip of grass as the machine is pulled along the roadside. This type of control is designed to be used on young green grass and weed growth. The searing action of the intense flame kills the plant tissues, and a second or follow-up burn removes the fire hazard. As with all other roadside burning operations, a water tank provided with high pressure pump should attend the work. It is anticipated that this machine, when somewhat improved, may prove especially valuable in mountainous areas where growth in the gutters and on cut and fill slopes on narrow winding right-of-way presents the greatest fire hazard.

Some work has been done in the past to eliminate roadside growth by chemical applications or with soil sterilizing agents. This has not proved successful for general roadside use due to the prohibitive cost of materials, the possible danger to livestock through poisoning, or because of unreliable soil reactions along any given roadside. Soil sterilization is practical, however, around guardrails, sight posts, bridge heads, structures, etc., and this practice is encouraged.

Many new chemicals have been produced in recent years which show promise as effective weed killers or soil sterilants. It is entirely possible that the present methods of roadside fire hazard control will become antiquated when these chemicals become commercially available and are within a price range which will justify their use as against present methods. A period of experimentation is always necessary in connection with such developments.



An improved control is provided by a burned firebreak placed from the gutter line up on cut slope

The benefits of the program from the public point of view are difficult to evaluate as the work is in the nature of insurance against loss. An uncontrolled fire leaves devastation behind, while a prevented fire leaves no record of fact. Until 1944, the occurrence of numerous fires was expected each season in a relatively small area of countryside south of King City, to cite one locality. These fires required the combined efforts of farmer-paid employees, railroad workers, and the men and equipment of the Division of Forestry for their control, which was only successful, perhaps, after some 2,000 to 25,000 acres of valuable grain, grazing, and watershed growth had been destroyed during each of several successive years.

In 1944, through the cooperation of the Southern Pacific Railroad, the State Division of Forestry, the State Division of Highways, and adjoining landowners, this menace was reduced by an estimated 100 fires and resulted in no serious loss to farmers. Although no appreciable loss had been suffered by farmers from fires originating on State highway right-of-way in this same area, the number of spot fires has been reduced by the roadside fire hazard control work from over 20 each year to fewer than five in 1944 and 1945.

This example is typical of what might be expected without the control which is now being exercised to protect certain types of agricultural lands adjoining State highways.

As is the nature of progress, it is not felt that perfection has been attained in roadside fire hazard control work. New methods, materials, and machines are continually being tested and given full consideration in an effort to improve the protection and to decrease the unit cost of this phase of highway maintenance work.

No More Copies of California Missions Available

CALIFORNIA Highways and Public Works has complied with so many requests for back issues of the magazine containing the articles on California Missions that the supply of these copies has been exhausted. It will be impossible to accede to any more such requests.

For the information of those readers desiring sets of the articles, the California Mission Trails Association, Ltd., will publish California Missions in brochure form with the same illustrations used in California Highways and Public Works. It is therefore suggested that those desiring the series of articles communicate with Mr. Ray Hewitt, General Manager, California Mission Trails Association, Ltd., 520 West Sixth Street, Los Angeles 14, California.

Highway Bids and Contract Awards for August and September, 1946

August, 1946

COLUSA COUNTY—In Williams between 293 feet south of "F" Street and "D" Street, about 0.3 mile to be repaired with plant-mixed surfacing. District III, Route 7. J. R. Reeves, Sacramento, $6,555; Lester L. Rice, Marysville, $6,974. Contract awarded to Harms Bros., Sacramento, $4,910.

CONTRA COSTA COUNTY—At San Pablo, between Wildcat Creek and San Pablo Creek, about 1 mile to be widened and paved with asphalt concrete on crusher run base, and traffic signal systems to be furnished and installed. District IV, Route 14, Section A. Lee J. Immel, San Pablo, $106,833.50; Independent Construction Co. Ltd., Oakland, $118,313; J. Henry Harris, Berkeley, $122,190.05. Contract awarded to J. R. Armstrong, El Cerrito, $101,210.50.

IMPERIAL COUNTY—Between Calexico and El Centro and in the city of El Centro, about 12.7 miles in length, portions to be graded, shoulders to be improved, and plant-mixed surfacing to be placed for the full length of the project. District XI, Routes 26,27, Sections J,E,Cn. Basich Bros. Construction Co. & Basich Bros., Alhambra, $246,214; Gunner Corp. & G. W. Ellis Construction Co., Pasadena, $257,772; Griffith Co., Los Angeles, $257,919.80; Arthur A. Johnson, Laguna Beach, $262,410.30; V. R. Dennis Construction Co., San Diego, $278,172.50; Peter Kiewit Sons Co., Arcadia, $288,475.40; Pacific Rock & Gravel Co., Monrovia, $348,611; J. E. Haddock Ltd., Pasadena, $365,718.70; R. E. Hazard Construction Co., San Diego, $364,367.50. Contract awarded to Tanner Construction Co., Phoenix, $244,795.30.

IMPERIAL COUNTY—At points near Winterhaven, eight timber bridges to be repaired. District XI, Route 27, Section B. E. G. Perham, Los Angeles, $29,909; Spencer Webb, Inglewood, $58,466. Contract awarded to Tanner Construction Co., Phoenix, $24,267.40.

KERN AND INYO COUNTIES—Between Mojave and Olancha, about 1.3 miles in net length, debris to be removed from existing roadbed, a portion to be graded and surfaced with roadmixed surfacing, and a seal coat to be applied to other portions and channels, dikes, and drainage structures to be constructed. District IX, Route 23, Sections B,C, E,G,H. Geo. E. Murray, Stockton, $46,164.60. Contract awarded to Brown & Doko, Pismo Beach, $45,914.

LOS ANGELES COUNTY—In the City of Los Angeles, on Arroyo Seco Parkway between College Street and Bernard Street, about 0.3 mile to be graded and paved with asphalt concrete, Portland cement concrete and plant-mixed surfacing. District VII, Route 165. Peter Kiewit Sons, Arcadia, $302,049.50; Charles T. Brown Co., San Fernando, $307,531.15. Contract awarded to J. E. Haddock Ltd., Pasadena, $285,710.20.

NAPA COUNTY—Four miles north of Vallejo at Station 410+75, a farm road undercrossing to be reconstructed. District X, Route 7, Section A. H. W. Ruby, Sacramento, $13,950; Kiss Crane Co., San Pablo, $15,120. Contract awarded to Minton & Kubon, San Francisco $12,258.

PLUMAS COUNTY—At various locations, furnishing and stockpiling plant-mixed surfacing. District II, Routes 21 & 83, Sections B,B,C. Frederickson & Watson Construction Co., Oakland, $4,863.80. Contract awarded to A. Teichert & Son, Inc., Sacramento, $4,770.30.

PLUMAS COUNTY—Between Route 83 near Almanor and Plumas-Lassen County line two miles west of Westwood, about 9.9 miles to be graded and surfaced with crusher run base and plant-mixed surfacing. District II, Route 523. Westbrook & Pope, Sacramento, $377,081.20; A. Teichert & Son, Inc., Sacramento, $490,944. Contract awarded to Frederickson & Watson Construction Company, Oakland, $367,267.32.

PLUMAS COUNTY—Across North Fork of Feather River at Chester. Sidewalk on bridge. District II, Route 29, Section A. O'Connor Bros., Red Bluff, $5,875; Kiss Crane Co., San Pablo, $6,525. Contract awarded to C. C. Gildersleeve, Willows, $4,716.

RIVERSIDE COUNTY—Between 1.3 miles north of Imperial County line and 0.5 mile south of San Bernardino County line, about 15.4 miles, portions to be repaired by placing road-mixed surfacing over the existing surfacing and portions to be repaired with imported base material and road-mixed surfacing. District XI, Route 146, Sections A,B,C, D,E. R. R. Hensler, Glendale, $65,352.50; Nevada Constructors, Inc., Reno, $87,037.10; Pacific Rock & Gravel Co., Monrovia, $107,460. Contract awarded to Arthur A. Johnson, Laguna Beach, $54,935.

SACRAMENTO COUNTY—In the city of North Sacramento on Del Paso Blvd. between Birch Avenue and El Camino Avenue, installing traffic signal system and constructing channelization facilities. District III, Route 3. Luppen & Hawley, Inc., Sacramento, $23,649. Contract awarded to R. Flatland, San Francisco, $18,668.

SAN DIEGO COUNTY—On Balboa Parkway at Sixth Street in the city of San Diego, a reinforced concrete undercrossing to be constructed. District XI, Route 77, E. S. & N. S. Johnson, Fullerton, $104,394; Carroll & Foster, San Diego, $105,565; Haddock Engrs., Ltd., Los Angeles, $105,852. Contract awarded to M. H. Golden Construction Co., San Diego, $98,197.70.

SAN DIEGO COUNTY—A reinforced concrete overcrossing over Balboa Parkway at Pasco Street in the city of San Diego to be constructed. District XI, Route 77, M. H. Golden Construction Co., San Diego, $82,791; Haddock Engineers, Ltd., Los Angeles, $89,655; Walter H. Barber, La Mesa, $94,931.82. Contract awarded to Carroll & Foster, San Diego, $79,508.

SAN MATEO COUNTY—On Whipple Road between Canada Road and Alameda de las Pulgas, about 2.9 miles to be graded. District IV, FAS 1052. Eaton & Smith, San Francisco, $215,039.54; N. M. Ball Sons, Berkeley, $225,414; Edward Keeble, San Jose, $232,924; Fredrickson Bros., Emeryville, $238,671.08; Guy F. Atkinson Co., South San Francisco, $244,265.20; Peter Sorensen, Redwood City, $259,699.94; Piombo Bros. & Co., San Francisco, $185,265.60.

SHASTA COUNTY—Between Schilling and Shasta, about 4.6 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District II, Route 20, Section B. H. Earl Parker & Clements & Co., Marysville, $515,558.30; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, $535,388.50; E. W. Elliott Construction Co., San Francisco, $549,113.70; A. Teichert & Son, Inc., Sacramento, $598,053.10; Frederickson Bros., Emeryville, $627,731; Morrison Knudsen Co., Inc., Los Angeles, $653,012.71; L. G. Lynch, Danville, $688,501.50; Guy F. Atkinson Co., South San Francisco, $688,770.90; Stolte, Inc. & E. B. Bishop, Oakland, $705,690.30. Contract awarded to Harms Bros. & N. M. Ball Sons, Berkeley, $494,627.40.

September, 1946

KERN COUNTY—Between Route 143 and Cottonwood Creek, about 6.3 miles to be surfaced with roadmixed surfacing. District VI, Route 57, Section E. Oilfields Trucking Company and Phoenix Construction Co., Bakersfield, $24,607.50; Ted F. Baun, Fresno, $25,420; Griffith Company, Los Angeles, $26,889.50; Geo. E. France, Visalia, $28,875. Contract awarded to Rand Construction Co., Bakersfield, $24,372.50.

MENDOCINO COUNTY—At Red Bank Creek and Lost Creek between Boonville and Yorkville, about 0.4 mile to be graded and imported base material placed. District 1, Route 48, Section A. J. Henry Harris, Berkeley, $37,828.25. Contract awarded to C. M. Syar, Vallejo, $29,966.70.

ORANGE COUNTY—About 18 miles north of Dobeny Park, the existing bridge across North Arm of Newport Bay to be repaired. District VII, Route 60, Section B. Chas. A. Dutro Associates, Los Angeles, $33,059.40; Cox Bros. Construction Co., Stanton, $63,520. Contract awarded to Case Construction Co., San Pedro, $31,660.10.

PLACER COUNTY—Between Route 37 in Auburn and Wise Canal, about 1.7 miles to be graded and surfaced with crusher run base and plant-mixed surfacing. District III, Route 17, Section Aub., C. J. R. Reeves, Sacramento, $182,947.85; N. M. Ball Sons, Berkeley, $188,578.25; Elmer J. Warner, Stockton, $197,621.50; H. Earl Parker & Clements & Co., Marysville, $234,037.25. Contract awarded to Frederickson & Watson Construction Co., Oakland, $182,335.11.

PLACER AND EL DORADO COUNTIES—At North Fork of American River, about 2 miles east of Auburn, a structural steel girder bridge to be constructed and about 0.26 mile of approaches to be graded and bituminous surface treatment applied thereto. District III, Route 65, Sections A,A. Harry J. Oser & Joe Garrick & Co., San Francisco, $254,540.50; Lord & Bishop, Sacramento, $269,872; Fredrickson & Watson Construction Co., Oakland, $318,348.05. Contract awarded to H. W. Ruby, Sacramento, $249,626.70.

RIVERSIDE COUNTY—At points near Indio, five timber bridges to be repaired. District XI, Route 64, Sections H,B. O'Rourke & Parker, Garvey, $29,732.20; Matich Bros., Colton, $32,960; Spencer Webb, Inglewood, $42,399. Contract awarded to E. G. Perham, Los Angeles, $22,026.10.

SAN BERNARDINO AND RIVERSIDE COUNTIES—Between one-half mile east of Ontario and Mira Loma, about 5.8 miles to be graded and surfaced with plant-mixed surfacing on cement treated base and existing bridge structures and culverts to be widened. District VIII, Route 19, Sections B,A. Griffith Co., Los Angeles, $437,731; Geo. Herz & Co., San Bernardino, $449,827.65; N. M. Ball Sons, Los Angeles, $505,927.20; Matich Bros., Colton, $528,319.40; J. E. Haddock, Ltd., Pasadena, $592,676.60. Contract awarded to Peter Kiewit Sons Co., Arcadia, $413,905.30.

SAN DIEGO COUNTY—Between 9th Street and Luneta Drive in Del Mar, about 0.6 mile to be widened with asphalt concrete and plant-mixed surfacing to be placed on shoulders. District XI, Route 2, Section A. N. M. Ball Sons, Los Angeles, $20,377.50; Griffith Co., Los Angeles, $20,627.15; R. E. Hazard Contracting Co., San Diego, $21,195. Contract awarded to V. R. Dennis Construction Co., San Diego, $18,380.50.

North Sacramento Freeway Construction Is Advanced

(Continued from page 18)

areas and through and over the structures, curbs are provided to prevent unauthorized crossing. Fences down the center division strip are also being placed in strategic positions to prevent pedestrians crossing the freeway. The freeway right of way will all be fenced. In the more developed areas, a chain-link fence is being placed while on the remainder of the perimeter through undeveloped land, an ordinary property fence will be placed.

The progress of the job in relation to the portion of the contract time which is elapsed is good. Although the contract time will not expire until the late fall of 1947, there is every reason to expect that the work will be completed by early summer of 1947.

The contract is being administered by District III with the Contractor the Guy F. Atkinson Company of San Francisco. H. F. Sherwood is the Resident Engineer for the District and A. L. Elliott is the Bridge Department Representative in charge of the structures.

SANTA CLARA COUNTY—On Leavesley and Ferguson Roads, between Gilroy and junction of Ferguson Road with Route 32, about 4.5 miles to be graded and paved with asphalt concrete. District IV, FS 992. Piazza & Huntley, San Jose, $139,380.64; N. M. Ball Sons, Los Angeles, $164,110.75; A. Teichert & Son, Inc., Sacramento, $165,553.80; Edward Keeble, Dan Caputo, and A. J. Raisch Paving Co., San Jose, $168,876.40; Peter Sorensen, Redwood City, $219,095.50. Contract awarded to Granite Construction Company, Watsonville, $148,648.10.

SANTA CRUZ COUNTY—At Waddell Creek, about 7.4 miles north of Davenport, about 0.3 mile to be graded, surfaced with plant-mixed surfacing and a reinforced concrete bridge to be constructed. District IV, Route 56, Section C. Dan Caputo & Edward Keeble, San Jose, $114,082; Peter Sorensen, Redwood City, $115,397. Contract awarded to Granite Construction Co., Watsonville, $88,995.50.

SOLANO COUNTY—Between State Highway Route 7 near Vacaville and 0.5 mile north of Sweeney Creek, about 5.7 miles to be graded and paved with Portland cement concrete pavement and five bridges to be constructed. District X, Route 90, Section A. N. M. Ball Sons, Berkeley, $546,103.70; A. Teichert & Son, Inc., Sacramento, $565,561. Contract awarded to Fredrickson Bros., Emeryville, $512,573.60.

SONOMA COUNTY—Across Russian River at Hacienda, between Guerneville and Forestville; a steel and concrete bridge to be constructed. District IV, Route FS 786. Carl N. Swenson Co., San Jose, $153,968. Contract awarded to Kiss Crane Co., San Pablo, $127,700.11.

Only 25 Toll Roads In United States

TWENTY-FIVE motor vehicle toll roads, 240 toll bridges, six pay-as-you-enter tunnels, and 561 ferries in the United States yield approximately $96,000,000 in a normal travel year, yet these toll-ways are few when compared with the Nation's 3,300,000 miles of roads and streets and tens of thousands of bridges.

Figures collected by the Public Roads Administration for 1940, show that all the toll roads in the United States total only 346.6 miles and that this includes the 160.7 miles of the Pennsylvania Turnpike which is the country's longest toll road and 46 per cent of our entire toll mileage.

The Wilbur Cross Parkway in Connecticut, 2.15 miles long, is the shortest public toll road. The longest private toll road is Heckscher Drive in Florida with 16.1 miles, and the shortest, the Mt. Agassiz Scenic Road in New Hampshire, is one mile long.

Four States, Arizona, Nevada, New Mexico and Utah have no toll facilities of any kind. Eight States, Delaware, Idaho, Indiana, Iowa, Kansas, Minnesota, Nebraska and Wisconsin, have no intrastate but one or more interstate service. Kentucky leads the Nation with 128 toll facilities, all bridges and ferries. New York is second with 78 which includes all forms, and Illinois rates third with 62 bridges and ferries.

Appointment Announced

Edward Hyatt, State Engineer, has announced the temporary appointment of V. G. Horton, engineer from the Sacramento office of the State Division of Water Resources, to the position of Construction Superintendent in charge of the Division's flood control maintenance headquarters at Sutter, Sutter County, left vacant through the recent resignation of James M. Berry who occupied that position for many years.

"On the day my wedding occurred . . ."

"Pardon the correction, but weddings, receptions, dinners and such affairs 'take place.' It's only calamities that 'occur.' Do you see the distinction?"

"Yes, I see. Well, as I was saying, on the day my wedding occurred . . ."

Ten-Year Highway Program Is Proposed to Joint Fact-Finding Committee

(Continued from page 4)

experience in the highway field, J. Paul Buckley and Carl E. Fritts. They had the responsibility of developing the technical data of the report, under Mr. Kennedy's direction. Robert L. Steinle developed the graphic presentation of the material, the art work and the layout of the report. Raymond F. Law served as writer and editor.

The State Division of Highways made available the basic material on the California Highway System. Much helpful information was obtained from other State departments.

The Public Roads Administration contributed materially to the study by providing information and personnel. Pierce A. Carmichael of the Sacramento office was loaned to the committee. Two members of the Washington staff, Fred B. Farrell and O. K. Normann, visited Sacramento to work with the engineering staff.

Thus, while the study was made independently, it represented the cooperative efforts of a large number of organizations, governmental agencies and individuals interested in highway development.

WATER MEETING TO BE HELD

San Francisco will be host to the 27th annual convention of the California Section, American Water Works Association, on October 23, 24 and 25.

The convention will open at 8 a.m. Wednesday the 23d with a golf tournament under the direction of Claude T. Faw. The entire morning will also be spent in registration at the Civic Auditorium. At 2:30 that afternoon Carl M. Hoskinson, Chairman of the California section, will preside over the opening of the technical sessions. Following a speech by San Francisco Mayor Roger Lapham, there will be three papers, "Water Development Plans in California" by Edward Hyatt, State Engineer; "State Highway Expansion and its Effect on Public Utilities" by Fred J. Grumm, assistant State Highway Engineer of California, and "The Effect of Owens Lake Litigation on Water Appropriation in California" by C. T. Waldo, deputy city attorney of Los Angeles, for the Department of Water and Power.

Fourteen Miles Three Flags Highway Resurfaced

(Continued from page 14)

The gravel base for the imported borrow and plant-mixed surfacing was obtained from a state-owned pit which is located along the ancient shore of the Great Basin or Lake Lahonaton and was composed of layers of gravel material ranging from very fine sand to medium coarse gravel in an alternating pattern which had a total thickness of approximately nine feet and lay on a formation of scattered two-foot boulders imbedded in a very fine sand with no gradation between the boulders and the sand.

IMPORTED GRAVEL BASE

The two-foot overburden properly blended with the underlying gravel made up the aggregate for the imported gravel base. The material was hauled to the main hopper by means of a 14-cubic yard Woolridge Scraper, powered by a D-1700 Caterpillar. The material from the hopper was carried to the screening plant by an 80-foot steel conveyor, powered by a 15 horsepower electric motor through a Pan-type automatic feeder. The screening plant consisted of a double deck Niagara scalping screen, powered by a 10 horsepower electric motor mounted on a two-compartment, 15-cubic yard steel bin.

The ¾-inch material was scalped and the imported gravel base delivered to the road by dump trucks and deposited in a windrow along each side of the roadbed by means of a Galion spreader box, mixed with water, laid and compacted.

The mineral aggregate for the plant-mixed surfacing was blended at the pit in the ratio of two parts of coarse and one of fines, and delivered to the screening plant from which it was stockpiled on top of a 40-foot wood tunnel by means of a 100-foot steel conveyor. The screening plant served only to scalp ¾-inch material. The aggregate was fed from the stockpile to the dryer through a 40-foot tunnel, with a 40-foot conveyor belt and 8-foot belt feeder, powered from a tail pulley, through a dryer, and fed by a hot elevator into a 3000-pound "Standard" paving plant, where it was separated into two sizes and mixed with liquid asphalt 200-300 penetration at an approximate temperature of 260 degrees Fahrenheit. The bitumen ratio was approximately 7 per cent. The material was hauled to the street in 5-cubic yard dump trucks where it was spread with a Barber-Greene paving finisher.

DIRECT THROUGH ROUTE

The total length of the project was 14 miles. The finished riding surface consisted of a two-inch by 20-foot pavement, with two-foot borders and a Class "A-Fine" seal coat in the 20-foot center portion.

This road is known locally as the Susanville-Alturas Highway, and is designated in the Federal Highway System as U. S. 395. Traffic consists of a small amount of local farm-to-market travel and a fairly heavy volume of through and interstate traffic. This road is a part of a direct through-route from Central Oregon and Washington to Reno and Los Angeles, and a considerable increase in this latter type of traffic is to be expected.

The contractor was E. B. Bishop and the work was done under the general direction of District Engineer F. W. Haselwood, and District Construction Engineer H. C. Amesbury.

Foreign Bitumen Experts On Visit to California

Fifteen bitumen experts from seven foreign countries, on tour of the United States to study road construction and maintenance, airport surfacing and related uses of asphalt, were guests of the Testing and Research Laboratory, Division of Highways, Sacramento, on September 27th. All are representatives of Shell Associates in their respective countries. The members of the party are:

England—John Frederick Thomas, W. L. Campbell, Charles F. Jackson, E. J. R. Kennerell, J. S. La Trobe-Bateman, Baron W. F. Van Asbeck.

France—George L. Linckenheyl, Paris.

Holland—F. W. Lutter, H. W. Slotboom, J. C. Stoop and Mr. DeGraaff.

Egypt—George Melville, Cairo.

New Zealand—D. H. Scott, Wellington.

India—L. A. T. Shannon, Bombay.

Australia—J. Wearing Smith, Melbourne.

Committees for A. A. S. H. O. Are Hard at Work

(Continued from page 5)

Grumm, J. G. Standley, R. H. Wilson, T. E. Stanton, T. H. Dennis, R. M. Gillis, J. W. Vickrey, A. M. Nash, E. F. Wagner, E. N. Whittemore, Hodge L. Dolle, Geo. C. Hadley, A. D. Griffin, Harold Norton, Roy Higgins, G. F. Hellesoe, F. W. Haselwood, C. H. Whitmore, Jno. H. Skeggs, L. H. Gibson, E. T. Scott, S. V. Cortelyou, E. Q. Sullivan, S. W. Lowden, P. O. Harding, E. E. Wallace, F. W. Panhorst.

Men's Reception Committee—A. H. Henderson, Chairman, Assistant Director of Public Works, California; G. F. Hellesoe, F. W. Haselwood, C. H. Whitmore, Jno. H. Skeggs, L. H. Gibson, E. T. Scott, S. V. Cortelyou, E. Q. Sullivan, S. W. Lowden, P. O. Harding, E. E. Wallace, Howard C. Wood, E. F. Wagner, S. W. Elliott, J. G. Standley, R. H. Wilson, T. E. Stanton, R. M. Gillis, T. H. Dennis, F. W. Panhorst, A. M. Nash, L. V. Campbell, R. H. Stalnaker, J. W. Vickrey, E. R. Higgins.

Earl Carroll Banquet Committee—F. W. Panhorst, Bridge Engineer, Chairman; R. N. Gillis, J. W. Vickrey, J. G. Standley, Harold Norton, Roy Higgins, T. G. Sibley, W. E. Rose.

Banquet Committee, Biltmore Hotel—R. M. Gillis, Construction Engineer, Chairman; F. W. Panhorst, T. H. Dennis, Fred J. Grumm, Harold Norton, Gilbert Clarke, Kenneth Treuholm.

Friday Caravan Committee—A. N. Nash, Engineer of Surveys and Plans, Chairman; S. V. Cortelyou, J. W. Vickrey, T. H. Dennis, Leo J. McCarthy, Wm. L. Mills. Aides—R. L. Coor-Pender and F. B. Cressy.

Broadcasting Program Committee—E. N. Whittemore, District Right of Way Agent, Los Angeles, Chairman; A. D. Griffin, Louis R. Ardonin, Leo J. McCarthy, Harold Norton.

Secretarial Service Committee—R. H. Wilson, Headquarters Office Engineer, Chairman; R. C. Myers, A. D. Griffin, W. L. Fahey.

Orator—"In this great land of ours there is no North or South, nor East or West."

Listener—"No wonder we frequently don't know where we are."

State of California

EARL WARREN, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

CHARLES H. PURCELL, Director of Public Works

A. H. HENDERSON, Assistant Director

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R. M. GILLIS, Construction Engineer
T. H. DENNIS, Maintenance Engineer
F. W. PANHORST, Bridge Engineer
A. M. NASH, Engineer of Surveys and Plans
L. V. CAMPBELL, Engineer of City and Cooperative Projects
R. H. STALNAKER, Equipment Engineer
J. W. VICKREY, Traffic Engineer
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S. W. LOWDEN (Acting), District IX, Bishop
PAUL O. HARDING, District X, Stockton
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HOWARD C. WOOD, Bridge Engineer, San Francisco-Oakland Bay Bridge and Carquinez Bridge

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A. D. EDMONSTON, Assistant State Engineer
GORDON ZANDER, Water Rights
G. H. JONES, Flood Control and Reclamation
W. H. HOLMES, Supervision of Dams
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CARLETON PIERSON, Supervising Specification Writer
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WADE HALSTEAD, Associate Estimator of Building Construction

DIVISION OF CONTRACTS AND RIGHTS OF WAY (LEGAL)

C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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California's Highway Builders Will Welcome American Association Of State Highway Officials

THE MEN who build California's highways are all set to welcome the road builders of the United States, Alaska, Hawaii and Puerto Rico at the Thirty-second Annual Convention of the American Association of State Highway Officials which will be held in Los Angeles, December 17th-20th.

With a $155,000,000 postwar highway construction program well launched, State Highway Engineer George T. McCoy and his engineering staff and the members of the California Highway Commission, headed by Director of Public Works C. H. Purcell are looking forward to the opportunity that will be afforded to exchange ideas on improved highway planning with the highway officials of other states and of the territories.

In the group meetings which will be an important feature of the convention, the department chiefs of the Division of Highways anticipate they will receive as well as give instructive information.

Just what the convention will mean to them is best expressed in the following symposium of their views:

By RICHARD H. WILSON
Office Engineer

THERE is probably no member of a state highway organization who is confronted with as great a variety of detail problems as the office engineer.

In most state highway departments, the operations under his supervision involve the problems of financing and portions of budget control; federal aid contacts and responsibility for coordinating state requirements with latest rulings of the Public Roads Administration; preparation and correlation of plans and specifications in the light of newest design standards and ever changing construction practice and procedure; together with multitudinous other details of both internal and external administration.

There is probably no greater aid to the adequate functioning of work under the supervision of the office engineer than the business sessions of A. A. S. H. O. meetings where the multifarious problems which are common to all state highway administrations are reviewed and discussed.

This is particularly true with regard to working out federal aid matters. In advancement of a construction program involving federal funds, numerous occasions arise which require opinions or rulings from the Public Roads Administration in Washington. In most all of these instances, time is the important element if the work is to progress, and the time consumed in correspondence through the district office, the division office, the regional office, and thence to the right individual in the Washington office, results in delays which play havoc with progress.

It is in the business sessions of the annual convention where the state administration can meet the P. R. A. official and discuss his problems. The exchange of viewpoints, those of the state on one hand, the P. R. A. on the other, compels discussion of many phases of highway matters, resulting in better mutual understanding; promotes democratic willingness toward compromise; and produces a healthy spirit of cooperation.

Such discussion and exchange is of inestimable value in getting things done in highway development.

By J. W. VICKREY
Traffic Engineer

THE MEETING of the American Association of State Highway Officials during December will be at Los Angeles, the city recognized to have the worst traffic situation in the world. This meeting will provide the opportunity for the Nation's traffic engineers not only to view and examine this snarl of motor vehicles first hand but also to sit down together and compare notes and ideas on what can be done about it. Certainly such an opportunity should prove to be of more value to all those who can take part than any other way of spending the necessary time.

We tell ourselves and others that highways are provided for the one purpose of moving people and their goods in a safe and orderly manner, and we strive to bring that about. Prior to the war here in California we thought we were making pretty good progress, and I believe that we were. But this postwar traffic boom has set us back on our heels. It certainly has taught us that there is yet much to be done by traffic engineers toward making streets and highways orderly and efficient traffic facilities.

The importance of motor transport in the general economy of the Nation is no longer a question in the mind of anyone. The problems presented by motor transport to highway engineers in general and to traffic engineers in particular are tremendous and far-reaching. Their solution will require the combined thinking of the best minds the Nation can produce. The Los Angeles meeting will provide the first postwar opportunity to get together for an all-out start on this job.

If you have not already done so, plan to attend the Los Angeles meeting. We are very sure that it will be well worth your time and will prove to be well worth the cost to your organization.

By R. M. GILLIS
Construction Engineer

A WINTER meeting is ordinarily a poor time to see much construction work in actual progress, but this year as hosts to the visiting highway officials we are particularly happy that the convention will be with us when the State has an unusually large amount of construction work under way and that the meeting is to be held in the center of an area where many contracts that we believe will be of interest to our guests are under way.

Because of the postwar program we have in the last year awarded over $60,000,000 and many of the larger of these contracts are still in operation in

the Los Angeles vicinity and Southern California.

The program committee has arranged a trip for Friday that will view a few of the contracts in progress in Los Angeles. In addition to the work that will be seen on this trip, there are a large number of projects being built in the Bakersfield, San Bernardino, and San Diego areas, any of which can be viewed in a one-day trip. In addition, either of the two prison camps operated by the Division of Highways can be reached in less than 100 miles. The contracts include many bridges, heavy grading, and some paving work.

The full day of December 19th has been assigned for the meeting of the Committee on Road Construction, and we are looking forward to the value of the more or less formal discussions that will be held then. We want to give you fair warning that we also expect to make the most of all the time that the convention affords to find out what you are doing and how and why you are doing it. We are looking forward to some highly profitable off-the-record discussions with our guests: we know that we are all going to have a fine time in the process.

By C. C. CARLETON
Chief Attorney

THE LEGAL staff of California's State Highway Department is most hopeful that at the Los Angeles meeting there will be an unusually large attendance of legal counsel representing the state highway departments of other states and territories.

At the American Association of State Highway Officials' annual meeting held at Salt Lake City, Utah, in 1931, it became apparent that there should be a regular panel of state highway counsel in attendance at each subsequent meeting, and as a result the Committee on Legal Affairs was duly created.

The committee, augmented by other highway counsel who are able to attend from time to time, has regularly met since its formation and besides the program papers and discussions at the committee meeting itself, there has been a steady exchange of information on legal and right of way subjects throughout the year among the attorneys who have become acquainted through this medium.

Members of California's legal staff have enjoyed the privilege of attending a number of the annual meetings in the past, and in addition to the pleasure of fraternizing with men engaged in similar pursuits, have never failed to bring back vital information obtained from discussing highway cases and situations with their fellow attorneys both in and out of the regular sessions of the Legal Affairs Committee.

Moreover, the visiting attorneys are always given the opportunity of meeting and hearing top-flight highway executives and engineers from all over the country who speak on subjects with which the attorneys themselves are so deeply concerned.

It is becoming recognized that the legal and right of way activities related to highways are becoming increasingly complex.

The creation of freeway systems of highways is multiplying legal and acquisition problems and it is expected that, among other subjects, the now

(Continued on page 41)

HIGHWAY COMMISSION GREETINGS TO A. A. S. H. O.

By FORD A. CHATTERS, Secretary State Highway Commission

CALIFORNIA'S seven-man Highway Commission, headed by Director of Public Works C. H. Purcell, joins in a unanimous and enthusiastic state-wide welcome to members of the American Association of State Highway Officials when they meet in Los Angeles, December 17th-20th.

Much progress has been made in California's highway construction program since the association last met here ten years age. This in spite of the war when military necessity limited work largely to maintenance operations and to access road construction, both sizeable tasks in so important a theatre of the Pacific War.

During the war, at the request of Governor Earl Warren and backed by a $12,000,000 legislative appropriation, California Highway Department engineers were busy on actual construction plans for postwar work estimated to cost $125,000,000. Rights of way, in many instances, were purchased so that, by October of this year, contracts had been let for some $60,000,000 worth of work. Normal annual new construction before the war totaled about $22,000,000.

It is the aim of the commission to keep planning well ahead of construction. In a State whose population has increased more than 2,000,000 in the last four years, and is steadily growing; in a State where much of its produce is moved by motor transport; in a State where seashore, mountain, and desert attract tourists almost the year 'round, there is a peculiar and always-pressing problem. Highway planners must be far-seeing.

California has 14,000 miles of State highways, a distance greater than from the North Pole to the South Pole. Weather conditions almost as varied are encountered—from the floor of Death Valley, traversed by a State highway, to almost perpetually snow-covered summits of the High Sierra. The State has 3,500 miles of highway on which snow removal is provided for in the budget. California highway engineers meet many perculiar and interesting problems.

The California Highway Commission appreciates the attention the forthcoming Los Angeles sessions will focus on highway planning and construction, in the West and throughout the Nation.

Joining Chairman Purcell in a genuine welcome to visiting officials are the following other commission members: Harrison R. Baker, Pasadena; Homer P. Brown, Placerville; James A. Guthrie, San Bernardino; F. Walter Sandelin, Ukiah; C. Arnholt Smith, San Diego, and Chester H. Warlow, Fresno.

San Francisco-Oakland Bay Bridge Completes Ten Years of Operation

By O. R. BOSSO, Associate Bridge Engineer

THE San Francisco-Oakland Bay Bridge with a record of traffic volume unsurpassed by any other vehicular toll structure in the United States, celebrated its tenth anniversary on November 12, 1946, by continuing to serve as the major transportation artery between the two metropolitan centers of San Francisco and Oakland. On this anniversary it is appropriate to review some of the outstanding features of 10 years of operation.

Ten years ago, on November 10, 1936, Chief Engineer C. H. Purcell, now State Director of Public Works, made a final inspection trip of the bridge accompanied by Bridge Engineer Charles E. Andrew, Engineer of Design Glenn B. Woodruff, and members of the Board of Consulting Engineers.

Long before dawn on Thursday, November 12, 1936, motorists had lined up to be the first to cross the bridge. By 12:30 p.m., the actual opening hour, streets and highways leading to the east and west approaches were jammed with vehicles.

Included among the many notables at the official opening day ceremonies were former President Herbert Hoover and former Governor C. C. Young, who were jointly responsible for the appointment of the Hoover-Young San Francisco Bay Bridge Commission.

On that memorable day of November 12, 1936, Mr. Purcell said: "This bridge stands today ready for motor transport with a saving of over $6,000,000 under the estimated authorization for its construction. It is available for the use of the public six months in advance of the scheduled completion date with a saving in cost of interest on bonds during construction of over $1,500,000."

Another speaker, RFC Director Charles Henderson, declared: "Great and magnificent as this structure is, it will not convey to the men, women and children crossing on its decks the unseen obstacles encountered in its building.

"Those whose engineering skill and science have created the bridge, the men far above the waters who have done the work, deserve the highest praise. It is not only a monument to the genius of Charles H. Purcell, the engineer in charge, it is a symbol of the unlimited capacity of modern men

Looking east toward San Francisco-Oakland Bay Bridge Toll Plaza. While this photograph was not taken during peak traffic, it shows to some degree the necessity for the additional toll-lanes which are to be constructed on the span





Looking west on the San Francisco-Oakland Bay Bridge from Yerba Buena Island. This photograph was taken a few days after the bridge was opened to traffic in 1936



This view of the Bay Bridge taken from almost the identical spot as the picture on the preceding page, shows how traffic on the span has increased in a ten-year period

working together through government to unify the physical world around them."

The City of Oakland which had started its celebration on Armistice Day, November 11th, continued its fiesta. The opening of the bridge signalized the start of the San Francisco celebration which lasted four days.

The United States Government coined a 50-cent piece commemorating the event and cachets were issued by the Post Office Department.

TRAFFIC INCREASES

In the first three and one-half days after the opening, the bridge carried a total of 228,913 vehicles.

During the first year of operation, the daily average number of vehicular crossings was about 25,000.

On August 12, 1937, by order of the Railroad Commission, toll schedules on the ferries were reduced to approximately one-half of those in effect on the bridge. As a result of this drastic reduction of tolls on the competing ferries, the traffic over the bridge during the year of 1938 dropped to about 23,600 vehicles daily.

With the opening of the Golden Gate International Exposition in February of 1939, and a reduction in bridge tolls from 50 cents to 40 cents per automobile in June of the same year acting as a stimulus, the traffic jumped to an average for the year of over 30,000 vehicles per day.

During 1940, with the continuation of the Golden Gate International Exposition, bridge tolls reduced from 40 cents to 25 cents, the discontinuance of the competing ferries, and the initial effects of America's defense preparation, bridge traffic increased to a daily average of 41,820 vehicles.

VEHICLES AVERAGE 60,000 DAILY

A sharp increase in the use of the bridge resulted from the tremendous expansion of industrial and military activities around San Francisco Bay during 1941 and 1942. Traffic reached a peak during the latter part of 1942, when, for several months, the daily average number of vehicular crossings exceeded 60,000.

With the extension of gasoline rationing to the Pacific Coast in December of 1942, bridge traffic suffered a sharp drop. In December, 1942, and January, 1943, the daily averages were 43,637 and 45,871 vehicles respectively. Recovering from the first impact of gasoline rationing, the bridge traffic gradually leveled off to an average of about 53,000 vehicles per day. Offsetting the restrictions on the use of private cars during the war period, the truck and bus traffic increased greatly to maintain a high traffic volume. The first month after V-J day, the bridge traffic jumped to 71,000 vehicles per day and, with slight variations, has continued at that level.

A record for a single day's traffic was established on Easter Sunday, April 21, 1946, when 79,016 vehicles crossed the bridge.

In 10 years of operation, the bridge has carried 166,910,000 vehicles and 191,440,000 interurban train passengers, and collected approximately $58,377,500 in tolls.

INTERURBAN TRAIN TRAFFIC

Interurban train service across the bridge was inaugurated on January 15, 1939. During the first two years of operation, the trains carried an average of 53,502 passengers per day. As a result of the abandonment of service over certain lines, a low point was reached in 1941, with a daily average of about 38,500 passengers. However, with the increase of industrial activities and the effects of the gasoline and tire shortage, the travel on the interurban trains increased at a high rate, reaching an average of more than 102,000 passengers per day during the year of 1945. With the removal of gasoline rationing and tire restrictions after V-J day, and the reduction of war activities during 1946, interurban train travel decreased to an average of approximately 78,900 passengers per day.

FINANCING

The bridge was originally financed by the sale of revenue bonds in the total amount of $73,000,000 to the Reconstruction Finance Corporation. In addition, an allocation of $6,600,000 was granted from the State Highway Fund to be used for the construction of the bridge approaches, subject to the requirement that, after the redemption of all revenue bonds, this amount would be refunded to the Highway Fund out of toll collections.

In 1939 a refinancing was effected and a new issue of 4 percent bonds, in principal amount of $71,000,000, was sold to a syndicate of investment houses. The specified redemption date of the last of these bonds was 1976. As of March 1, 1944, the California Toll Bridge Authority had outstanding $57,070,000 of these bonds subject to call and redemption as a whole on March 1, 1945.

On May 5, 1944, the California Toll Bridge Authority adopted a resolution authorizing the creation of an issue of not exceeding $60,000,000 principal amount of San Francisco-Oakland Bay Bridge Toll Bridge Revenue Bonds. On May 22, 1944, the authority, after due notice, sold $56,000,000 principal amount of the bonds, due September 1, 1962, at an average interest rate to maturity of 1.96613 percent, effecting a saving of $5,097,000 in interest cost.

BOND REDEMPTION

The purpose of the new issue was to provide funds which, together with other funds available for that purpose, were sufficient to redeem all of the outstanding bonds at the redemption price current on March 1, 1945. All of the bonds are redeemable as a whole by the authority on any date on or after March 1, 1950, and prior to maturity. Should revenues continue at the 1946 level, all outstanding bonds will have been retired by 1952.

In addition to making it possible to advance the date on which the bridge bonds will be redeemed, the large traffic volume has also resulted in a series of reductions of automobile tolls from the initial rate of 65 cents per car plus 5 cents per passenger in excess of four passengers to the present rate of 25 cents per car with no charge for additional passengers. Corresponding reductions have been made in other vehicle classifications.

BRIDGE MAINTENANCE AND OPERATION

The various maintenance and operation departments of the bridge, after four years of struggling with manpower shortage, gradually are regaining their prewar strength. During the war, 74 employees of the bridge maintenance and operation staffs served in the armed forces of the United States.

Since the opening of the bridge on November 12, 1936, 9,050,000 government vehicles, and 31,316,000 government personnel on interurban trains, have crossed the bridge without payment of bridge toll. The larger part, by far, of this free traffic took place during the war years.

The amount of government toll-free traffic tells only a small part of the story of the contribution of the bridge to the war effort. Without the bridge, the war industries and shipyards in the San Francisco Bay area would have been hampered enormously and their

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Stockton-Lodi Limited Freeway Postwar Project Well Under Way

By P. O. HARDING, District Engineer

CONCRETE paving operations are well started on one of District X's most important postwar projects which lies between the Calaveras River, four miles north of Stockton, and Lodi on State Route 4 which is also a portion of U. S. 99 and U. S. 50.

This contract is 8.2 miles in length and includes the construction of two additional lanes of concrete pavement, which with the existing two lanes will provide, on its completion, a four lane, divided limited access freeway.

State Highway Engineer McCoy in his article in the last issue of "California Highways and Public Works" shows a traffic gain for the year 1946 over the year 1945 on State Route 4 of 69.51 percent on Sundays and 48.56 percent on Mondays. This traffic is considered typical of the section of road in question, which is presently carrying over 8,000 vehicles average daily traffic or some 3,000,000 vehicles annually. This provides some 25,000,000 annual vehicle miles of travel of which about 20 percent is truck traffic.

This mixed traffic has been conducive to numerous accidents, some 72 percent of which have involved two or more vehicles, which is typical of a congested highway. As a matter of fact, two county roads between Stockton and Lodi, namely, the Lower Sacramento Road (the old original state highway route) and West Lane are purposely used by many local residents in preference to the state highway route because of the heavy congestion on the latter.

It is estimated that upon completion of the present project much of this local travel using county roads will normally return to the highway and cause an immediate jump in traffic.

Using the year 1970 as a basis of project design, peak daily travel is estimated at 25,000 vehicles with a peak hourly traffic of 2,500 vehicles, for a design speed of 60 miles per hour for this mixed traffic.

Axle weight distribution data indicates over 11,000,000 equivalent 5,000-pound wheel load repetitions, in a 10-year period, in one direction, calling for a pavement design of the heavy industrial type. Our experience with the heavy faulting occurring at the joints of the existing two-lane pavement (which was brought to such forcible attention on all concrete pavements throughout the war period) substan-

(Continued on page 38)

Showing mixer charging. Also front view of spreading machine





Looking northeast from beginning of project, showing relocation in Auburn. Placer County Court House on right

Old "Diggins" Scene of Road Work

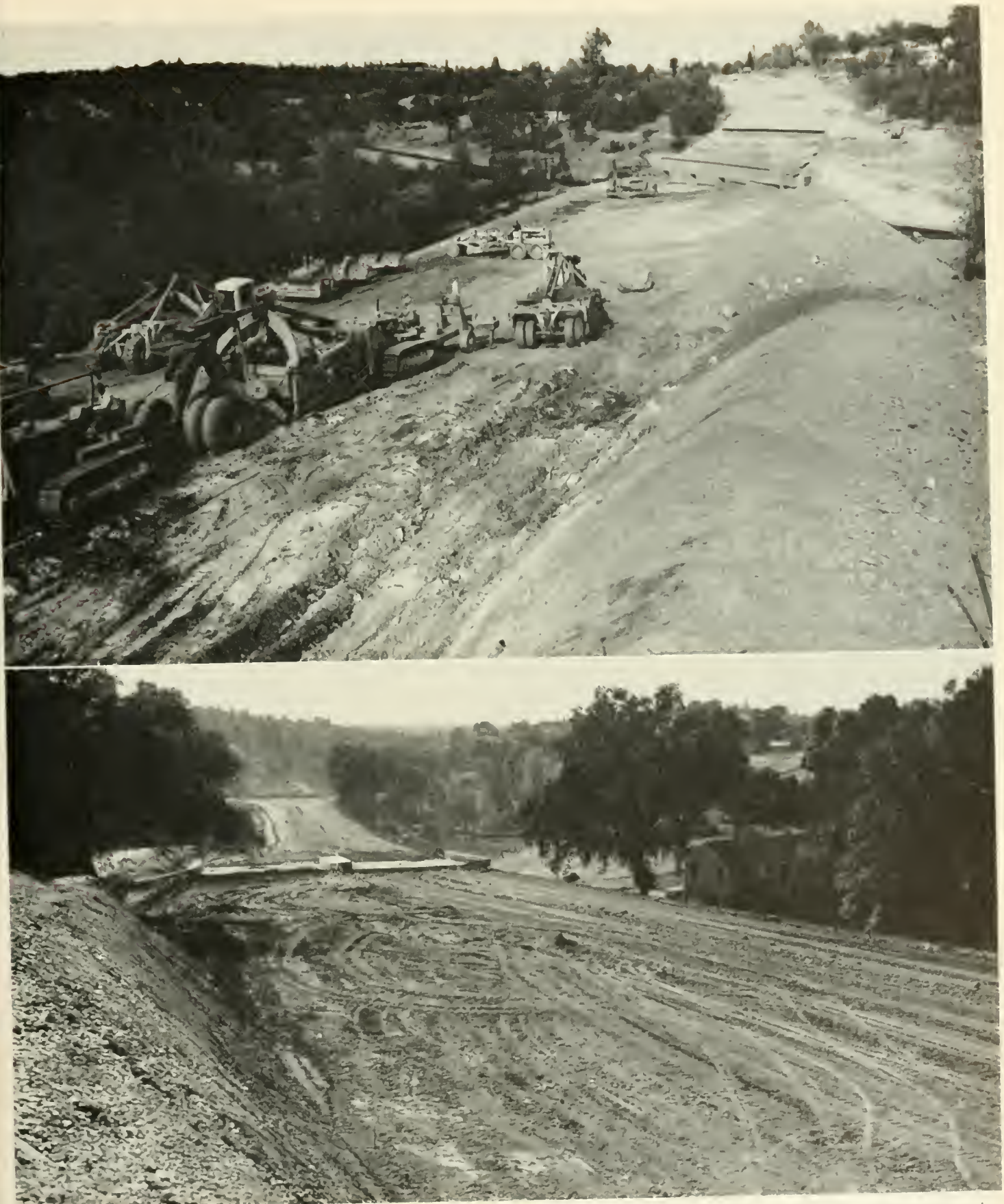
By J. L. PIPER, District Construction Engineer

WHERE Auburn Ravine flows through the City of Auburn, the California Division of Highways is constructing a limited access highway through the early day "diggins" of placer miners. Several million dollars in gold was taken from the same area where huge carryall scraper units, air compressors, and power shovels have taken the place of the picks, shovels, and sluice boxes of the pioneer toilers. To accommodate the high standard alignment on this project the old channel has been filled in and a new channel excavated through solid rock formation.

The work now under way lies between one-tenth of a mile west of Nevada Street and one mile east of Auburn, 2.56 miles in length. It consists of grading and paving with Portland cement concrete a four-lane divided highway with a 6 foot division strip through the City of Auburn. Where the new construction joins the existing roadway of U. S. Route 40 the four-lane pavement is tapered to two-lane construction. The width of each lane of pavement will be 22 feet, exclusive of the gutter. A curb and gutter around the division strip will provide an additional one foot of effective pavement width to obtain a total width of 23 feet or 12 feet on the inside lane. The concrete pavement will be uniformly eight inches thick. Shoulders will be eight feet wide, two feet of which will be surfaced with plant-mixed material.

Under previous contracts, awarded early in 1946, an undercrossing was constructed at Walsh Street, and overhead crossings are being built at East Street and across the Southern Pacific Railroad tracks. The completion of the latter two structures has been delayed due to the inability of the contractor to obtain the necessary structural steel girders. It is anticipated these two

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Upper—Grading equipment constructing fill near Southern Pacific Overhead. Lower—Looking west across Walsh Street Undercrossing during construction

Last Unconstructed Unit of Road Between Susanville and Reno Built

By H. B. MILNER, Resident Engineer

THE FIRST highway project in District II under the postwar construction program was completed by the Utah Construction Company on September 13th at a cost of $236,888.98. This contract, awarded January 17, 1946, called for grading and surfacing of 7.49 miles of Route 29 in Lassen County between Bird Flat and Doyle.

This was the last unconstructed unit of the interstate road between Susanville and Reno and its completion is a marked service to traffic. This road is also a part of U. S. 395 commonly known as the Three Flags Highway and connecting Canada and Mexico.

The old route between Bird Flat and Doyle was the original county road taken over for maintenance by the State in 1926. Except for the eventual establishment of a two-lane oiled mat and one minor line change, no improvements were made on this road of low standard alignment and grade in 20 years. Winter conditions on this road were particularly poor since the traveled way was almost entirely in a trench which so readily filled with snow and which was so difficult to drain.

The new route, avoiding the meanderings of the old one, runs directly between the termini with one 14,000-foot radius curve around a low ridge that projects into the valley near the center of the project and a 5,400-foot radius curve at Doyle. The grades are light and long sight distances permit a safe speed.

In order to secure direct alignment, two crossings of Long Valley Creek were necessary. This creek drains a comparatively large area of land east of the Sierras extending well into Nevada. Tripple 12-foot by 10-foot concrete box culverts which proved to be the economical type, were selected as adequate after detailed study of flood behavior since 1914, and a less detailed review extending back to 1878 when the Nevada, California and Oregon railroad was constructed. The average grade of the stream is about .04 per-



Triple concrete box in Long Valley Creek. The wing fence is to promote silt deposit on flat to the left

cent and a continuous bed load of granitic sand is carried even in periods of low water. The long wing walls are curved at the junction with the culvert and are designed to improve flow conditions at the entrance and to reduce turbulance at the outlet. The wing fence shown in the photograph is intended to promote the deposit of sediment in the broad area back of it, formerly occupied by the meanderings of the old channel.

The soil traversed by the road is granitic in various stages of weathering to deposits containing a large percentage of sound particles up to three-eighths inch in diameter. The base was generally made of native soil with such selection and cross haul of the better material as was necessary to obtain the required stability.

The low ridge which extends into Long Valley and is cut by the road is composed of angular to worn rock or gravel deposits intermixed with the coarser three-eighths inch granitic aggregate. During the construction of the Sierra Ordnance Depot at Herlong, four miles from Bird Flat, in the early years of the war, enormous quantities of aggregate, variously estimated as approaching 1,000,000 tons, was removed from this ridge.

The centerline of the highway crosses the ridge where the upper 10 feet consists entirely of the three-eighths inch granitic aggregate. The grade at this location was lowered to provide in the roadway cut sufficient aggregate for the plant-mixed surface and for strengthening some of the base. This lowered grade line also provided the desired sight distance at the vertical curve.

This granitic aggregate is nonplastic and mixed with asphalt meets the stability requirements. Asphalt of 200-300 penetration was used. A type "D" or flush seal was applied to the completed surface.

The graded width of the roadway is 32 feet. The pavement is 22 feet wide and 0.33-inch thick. Shoulders were surfaced to a width of five feet, the thickness tapering to 0.17-inch at the outer edge.

The Utah Construction Company of Salt Lake City did the construction work. Harry T. Walker was superintendent for the contractor. The State was represented by H. C. Amesbury, District Construction Engineer, and H. B. Milner, Resident Engineer.



Two views of recently completed improvement project on State Route 29 in Lassen County, between Bird Flat and Doyle. Upper—Looking east toward Doyle from a point 7.4 miles west. Lower—Looking east toward Doyle from a point 4.3 miles west

Application of Coordinate Methods to Freeway Planning and Construction

By G. M. LEATHERWOOD, Assistant District Location Engineer

The following article explains the adaptation and use of the coordinate method of ground control to the survey, design and construction of Metropolitan Freeways by District VII of the California Division of Highways.

In projects as complex and of the magnitude of the metropolitan freeway systems now being planned and designed in many cities of the United States, it may well be that other state highway departments or planning agencies have utilized this ancient and flexible system in their freeway or parkway planning. If they have not, the advantages outlined in the following article appear to indicate that the flexibility, accuracy and economy of the methods outlined are worthy of widespread use. The nature of the procedure has been amply demonstrated by the Division of Highways of the State of California in developing the designs for a number of complex projects in the Los Angeles area.

FRED J. GRUMM,
Assistant State Highway Engineer

THE development of super highways emphasizes the need for a centralized source of engineering survey data. The magnitude and complexity of such highways requires specialized branches of highway engineering to synchronize their efforts in order to maintain equilibrium in a constantly changing scheme. Highway design encompasses numerous special branches of engineering and during the earlier stages remains in a fluid state until the various features become fixed. It is evident during this period that a common base for calculations should be available to all. A desirable base is one that will lend itself with equal facility to both office and field use. For this purpose the plane rectangular coordinate system appears to suit conditions best.

The coordinate method has been widely used in most engineering fields, including highway engineering. The purpose here is to illustrate its interdepartmental value and to point out the need for common control for field as well as office use. In order to illustrate the methods used from the beginning of surveys to construction a theoretical example will be used.

THEORETICAL EXAMPLE

Consider that the project runs diagonally across a highly developed section of the city. The routing has been adopted and all that remain are surveys, design and right of way engineering. The importance and magnitude of the project are such that surveys are planned in detail. Base maps of the city are obtained and strip maps covering the routine are made. These strip maps, outlined in color, are furnished to the survey crews for field control.

One set of prints shows the outline of the city street system involved, another is outlined showing the outer perimeter for topography control, a third set is colored showing the city street system that is to be cross-sectioned, and a fourth set indicates the proposed construction area. The latter set is used to establish permanent bench marks in the clear of construction and temporary bench marks within the area for convenience of the cross-section crews.

WORK OF TRAVERSE CREWS

The first crews in the field are assigned portions of the street system to traverse. They generally develop the center lines from data furnished by the local engineering agency responsible, i.e., city engineer or county surveyor. The traverse crews work to an accuracy of 1:20,000. Their efforts are directed toward measuring distances and angles encompassing the system. They paint the stationing on the center line of street as the work progresses, for use of the topography and cross-section crews.

The largest perimeter within the system of the portion assigned is traversed, then the individual streets within this perimeter. This information is forwarded to the office where it is analyzed, adjusted and coordinated. The bench level, topography and cross-section crews follow, forwarding their data to the office as the work progresses. They color the base maps of their section, showing the portions completed in order that additional crews may work in the same area without duplication of effort.

SKELETON MAPS

In the interim, office engineers are preparing skeleton maps. These maps are single line drawings on tracing cloth. They show the proposed route, center lines of the street system, measured distances, adjusted distances, bearings and coordinates to all intersection and angle points. These coordinated skeleton maps are distributed to other agencies that have an interest in the project. These agencies normally consist of the departments within the organization and also outside agencies such as city, county and public utility engineering departments. The various agencies mentioned use the coordinated map values to tie in and compute whatever work they are doing, the final result being a set of plans and maps containing coordinate values to all important control points.

The maps mentioned in the above paragraph are shown in **Figures 1 to 4** inclusive. **Figure 1** is a coordinated base control map of a highly developed portion of the city, with a uniform rectangular street system. The single diagonal line is the proposed parkway

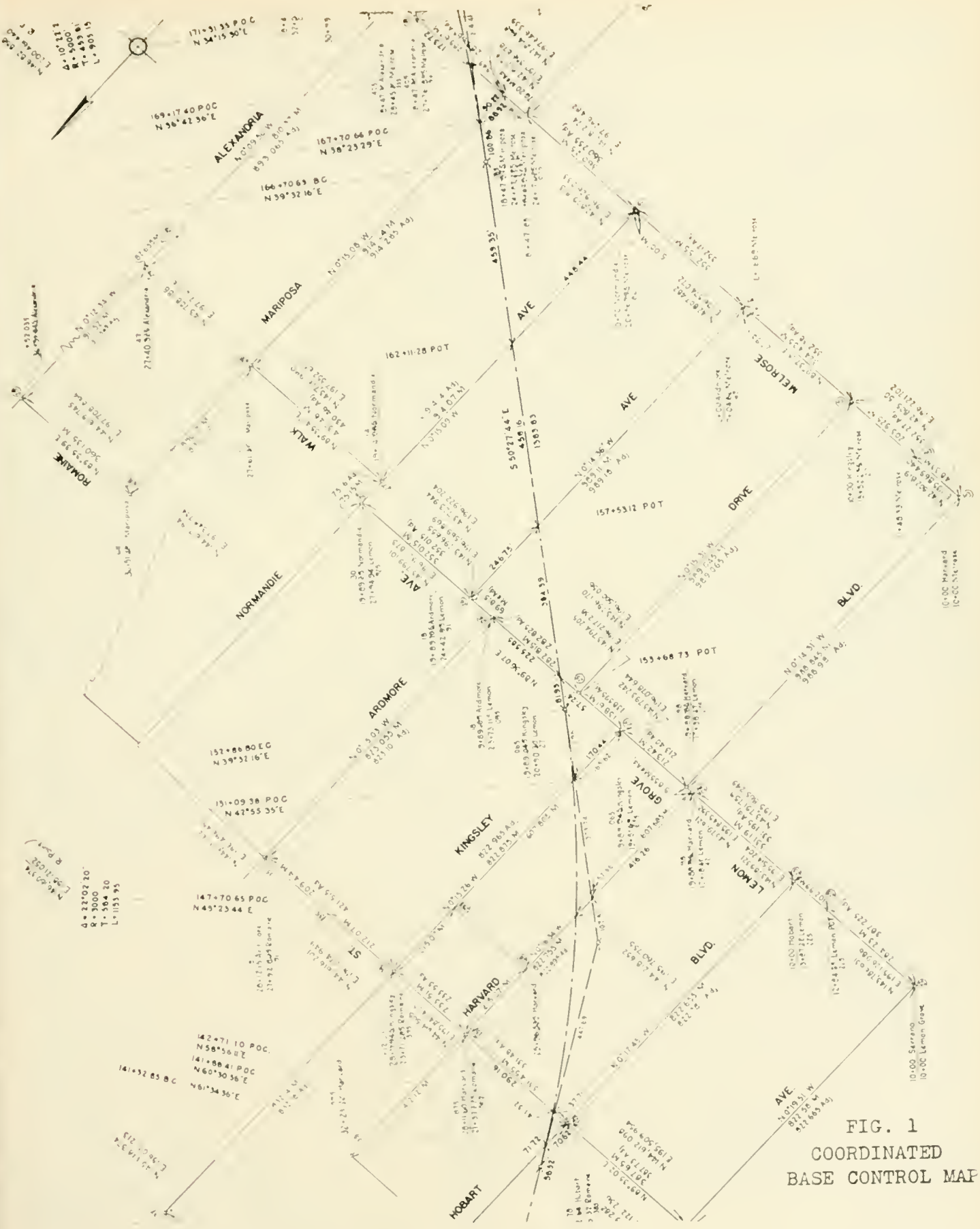


FIG. 1
COORDINATED
BASE CONTROL MAP

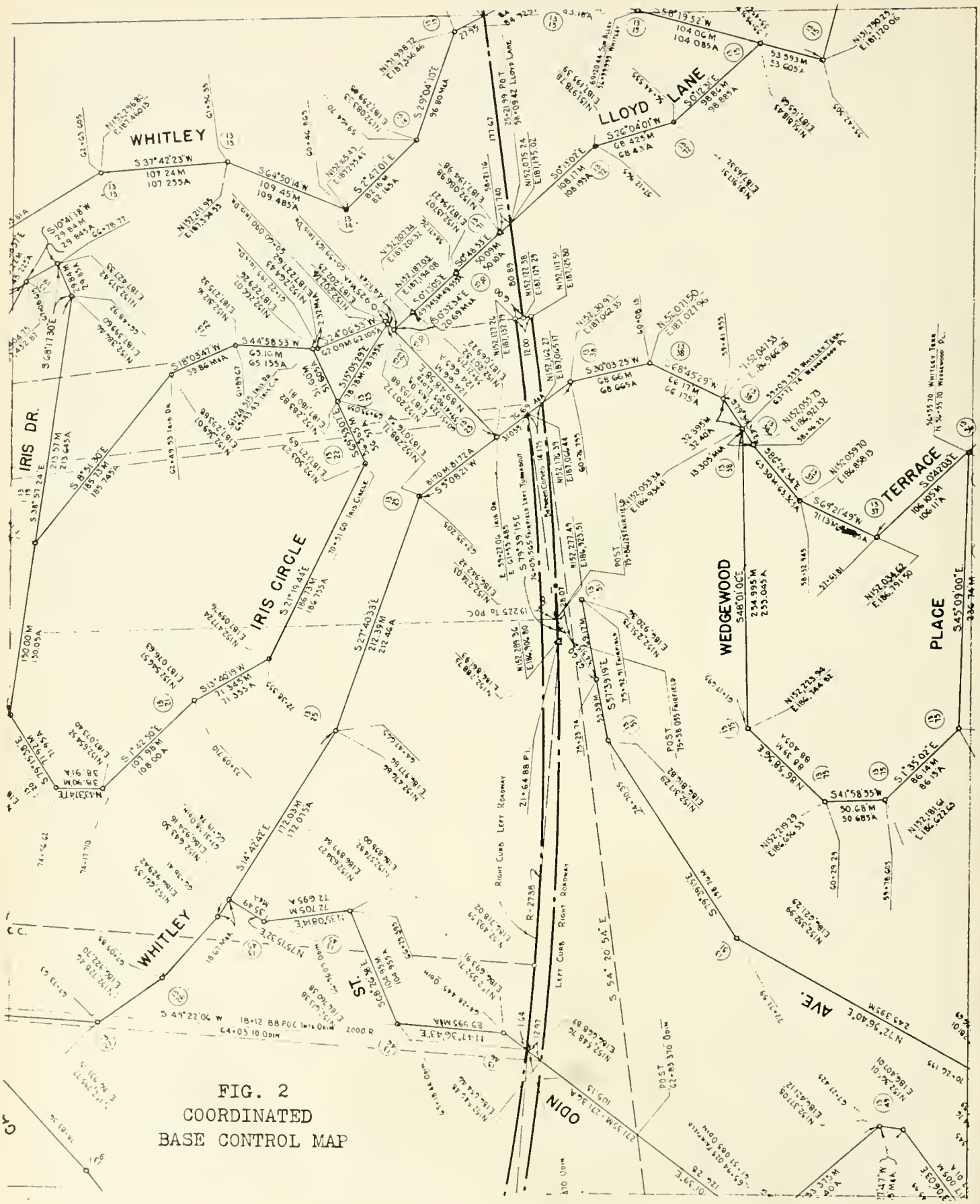


FIG. 2
COORDINATED
BASE CONTROL MAP

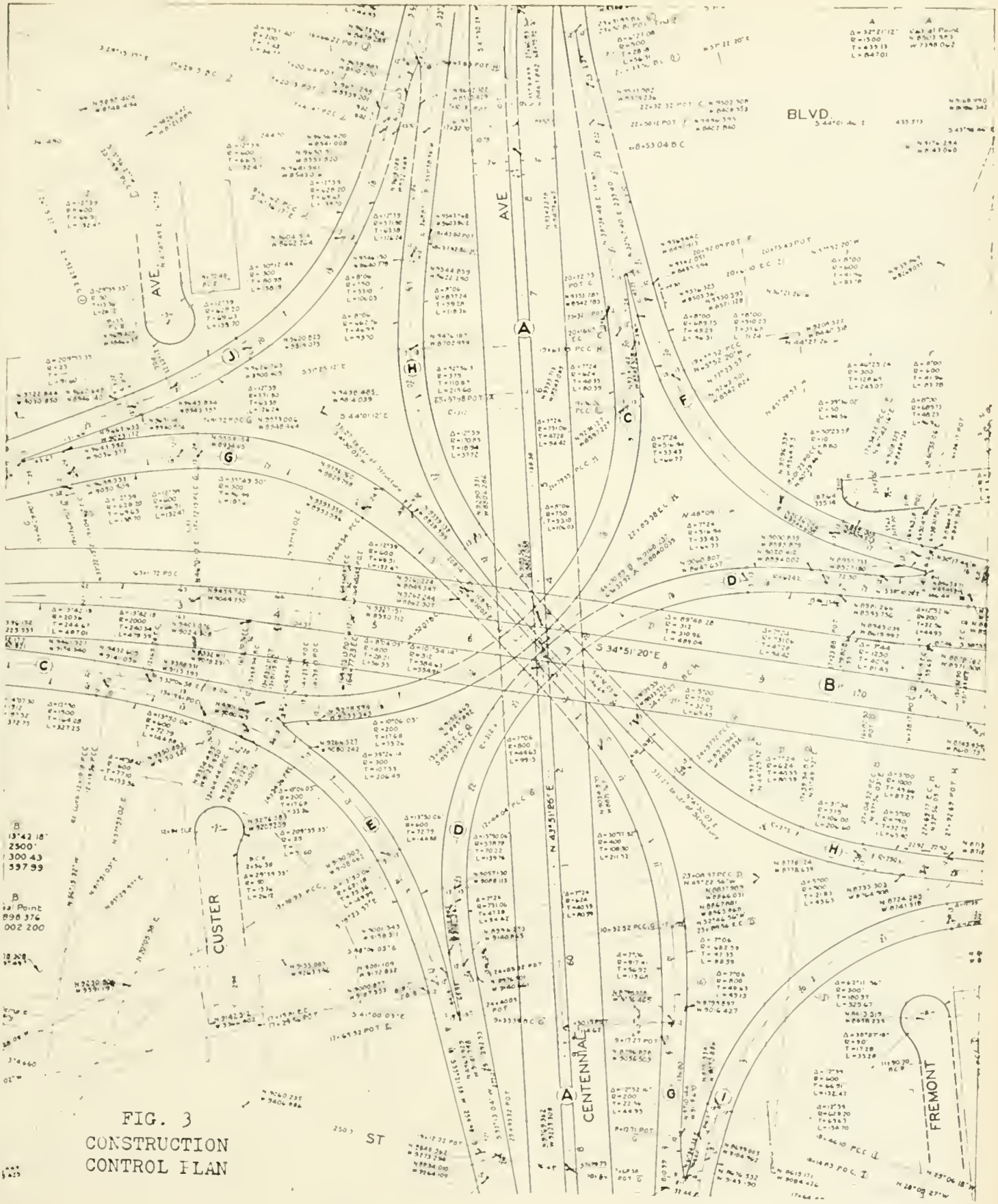


FIG. 3
CONSTRUCTION
CONTROL PLAN

alignment, showing ties to the street system.

CONTROL MAPS

Figure 2 is also a coordinated base control map of a highly developed portion of the city. The terrain is steep, rolling hills, artistically developed with beautiful homes and winding drives. The proposed parkway development is partly shown as a double line. This is caused by the right and left roadways converging and therefore not concentric.

Figure 3 is a portion of a construction control plan of two intersecting parkways. The magnitude and complexity of an intersection of this type requires positive construction control. Close observation of this figure will show that all important control points are coordinated and alignment and curve data sufficient to replace any portion.

Figure 4 is a coordinated construction plan. This plan differs from **Figure 3** inasmuch as all control values are shown and there is no need for a construction control plan. It should be noted that the right of way line consists of an irregular line that would ordinarily be difficult to establish, particularly on the outer roadway between Station 91 and Station 92 where provision had to be made to save an oil well. The right of way line offsets around this well and damage is prevented by the construction of a reinforced concrete wall. It should be further noted that all construction control points have been coordinated and are shown enclosed in rectangular blocks.

PRACTICAL USES

The practical use of these coordinated plans and maps is endless; but, for the purpose of illustration, consider that the aforementioned project has been let to contract. The various plans are complicated by underground structures of all types with attendant surface connections, under and overpasses, on and off ramps, deceleration and acceleration lanes, retaining walls, etc. Add to this the right of way which consists of a series of irregular jogs, curves, bays, etc., that are necessary due to design, damage and ownership problems.

Under the conditions explained, the skeleton base map along with the coordinated plans permits the construction survey crew to retain survey control. It is no longer necessary to tie out points in order that the center line may be replaced. In most cases chained or intersecting ties cannot be used effectively, due to the wide widths of the construction areas and the contractor's activities.

COORDINATE METHOD

The coordinate method of staking any particular item on the contract is to take off from any known undisturbed coordinated point, establish a temporary point in the vicinity of the item or items to be staked, and then tie into a second known undisturbed coordinate point.

If these points have not been disturbed, the error of closure will fall well within 1:10,000 which satisfies the construction accuracy. The temporary point is occupied and the necessary points for construction control are set. How simple when compared to reestablishing of center line, base line or layout lines under difficult construction conditions.

Coordinate control is a valuable asset. If not mishandled it permits small increments of a contract to be staked with the knowledge that all the parts will fit together as it nears completion. Points may be set to whatever accuracy that is needed. An endless variety of combinations, using coordinates, may be used depending upon conditions at the time of need.

RIGHT OF WAY PROBLEMS

Right of way presents another perplexing problem. The irregularity of these lines due to small individual parcels of land involved, as well as certain construction features, will not permit much latitude by traverse or plus and offset methods. The coordinate method is once more the answer to this problem. Points are set on the property corners or right of way line to the degree of accuracy necessary, depending upon their permanency and their use. The important feature is that small sections of right of way may be staked with accuracy, confidence and speed.

A question which may have occurred to the reader is: "If a theoretical straight line has been projected on a diagonal through a number of city blocks, would there not be a slight angle at each intersecting street?"

The answer is, "Yes."

When the right of way has been cleared of all obstructions a transit line would show that the intersection points set by ties from the nearest intersection would not necessarily check by a small amount, depending upon the distance between them. It then becomes obvious upon further examination that these slight angles do not materially change the design of construction nor do they disturb the description of the right of way lines.

From this line of reasoning it is evident that the project has been divided into individual sections between intersecting streets and the whole tied together by coordinate control. It is further reasoned that the right of way lies between individual parcels of land on either side; therefore if the individual parcels bounding the right of way are defined, then the right of way consists of the remainder. Should the problem be considered from the usual method, that is, the right of way established from ties to the base, layout or center line, there would be a greater chance of encroachment onto private property, with the added danger of damage.

BOUNDARY LINE CASES

Another question might be: "How are the boundary lines of the individuals' parcels determined?" In most cases it is rather simple inasmuch as most of the land in the west has been divided up by subdivisions, and therefore the individual parcels are proratable within the blocks, with certain rare exceptions. These exceptions occur when lines of possession defined on the ground do not agree with the recorded subdivision. Should it prove upon analysis that lines of possession will hold, then the error is considered to have been made in the original survey. Upon completion of the analysis, coordinates are computed and shown on the right of way maps. At some later date should the position of these points which define the right of way line be challenged, it would be a rather simple matter to check. If an error exists, adjustments would be made to the satisfaction of the injured party or parties. This plan has been given careful consideration and weighed against other methods. It was found that the savings in survey and office work by the plan outlined justify the slight cost and inconvenience that may occur when errors are found.

The coordinate method of base control has been in actual use both in the office and on construction and has definitely proven its value.

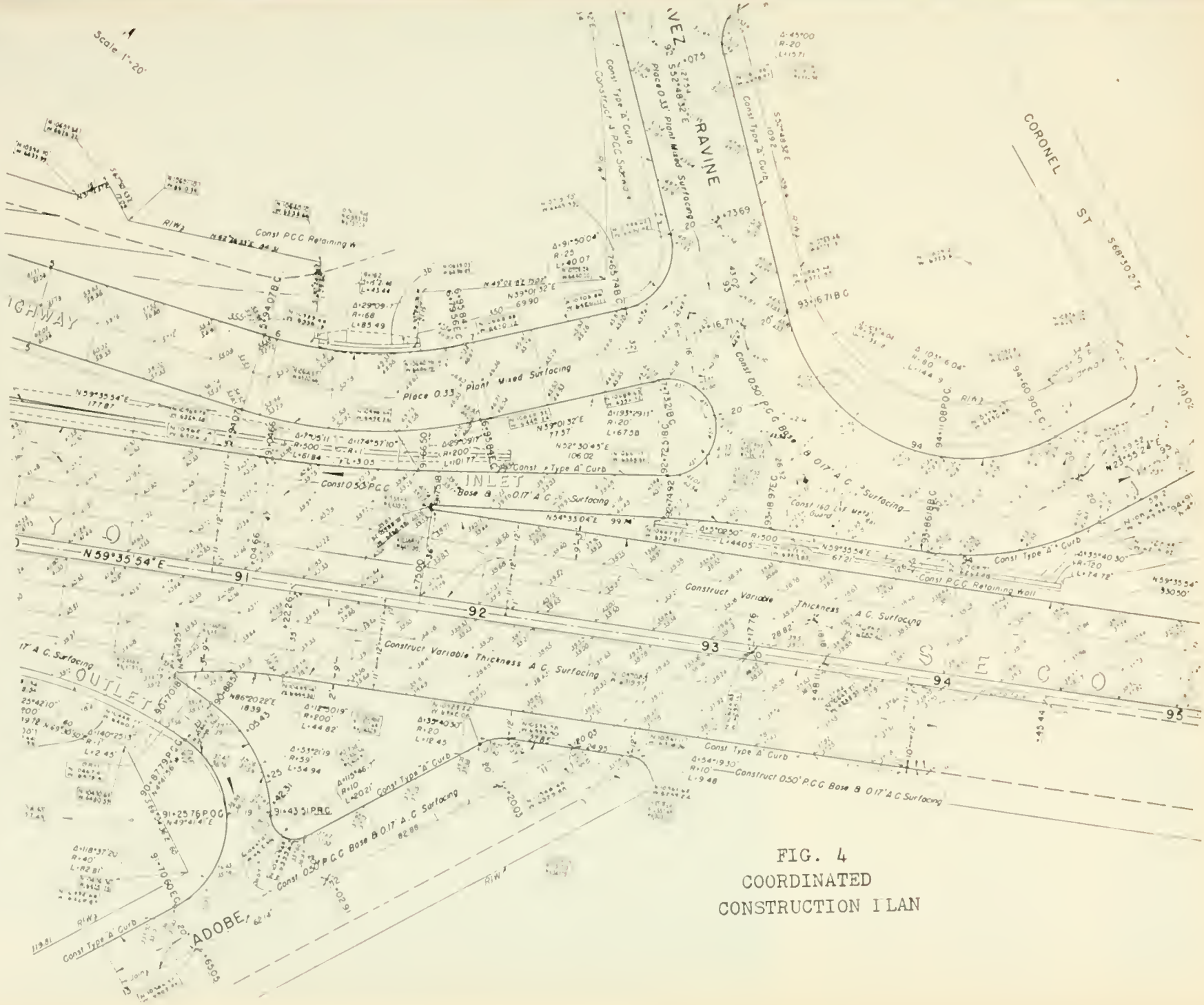


FIG. 4
COORDINATED
CONSTRUCTION PLAN

State Route 77 Is Being Modernized Between San Diego and Riverside

By R. A. HAYLOR, Associate Highway Engineer

STATE Route 77 between San Diego and Riverside is being transformed from a narrow, crooked highway with resultant numerous traffic delays to a modern streamlined highway where delays will be practically nonexistent. Since 1938 when preliminary plans were started for improving Route 77 within the City of San Diego, District XI has been more or less continuously engaged in planning for the improvement of this north-south artery.

In 1941, Prison Camp 38 was moved to Moosa Canyon, about 14 miles north of Escondido, and the first work was begun on San Diego's greatest major relocation in recent times. In five years prison labor has completed about 16 miles of two-lane roadway to high standards and is now working on the five-mile gap just north of Escondido. When this portion is completed there will be a savings in distance of about 13 miles over present U. S. 395, with new construction of only 23 miles.

CABRILLO FREEWAY

The most important and probably the most interesting link in the reconstruction is Cabrillo Freeway within the City of San Diego. About seven miles of Route 77 is being constructed

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This aerial view shows Cabrillo Freeway in San Diego under construction



Quality Tests for Asphalts—A Progress Report

By F. N. HVEEM, Staff Materials and Research Engineer

ANYONE having more than a casual knowledge of the behavior and characteristics of asphaltic paving materials is aware that most of the standard tests do not indicate the actual quality or suitability of asphalts for road building purposes. Asphalts which meet all of the usual specification requirements may prove to be more or less unsatisfactory and, conversely, cases have been known where materials which do not meet orthodox test requirements have given excellent performance.

A vast amount of research work has been done in an endeavor to improve this situation and numerous test methods and procedures have been tried in search of an answer to the problem of establishing *quality tests* for asphalt.

Perhaps at this point it will be helpful to trace briefly something of the history of established test procedures. To a large degree these are either a rationalization of preconceived ideas with mechanically improved means for standardizing rule-of-thumb methods, or are developments of analytical procedures typical of general laboratory practice.

In the days when the design of asphalt paving mixtures rested largely in the hands of construction superintendents or "hot stuff" foremen, i. e., the type of individuals usually designated as "practical men" it required considerable experience and the exercise of some ingenuity in order to detect differences in character of materials. Asphalts were, undoubtedly, subject to at least as many variables 40 years ago as at present, and a paving man would often shape a small piece of paving asphalt and stretch it by hand in order to determine if the material was "short." From observing this practice Dow developed the ductility machine making it possible to stretch a sample of asphalt under controlled conditions. (At the present time, however, it appears to be very difficult to establish any simple relationship between the results of such ductility tests and performance.)

TEST METHODS

Many "old timers" could make a very good estimate of consistency by chewing a sample of asphalt and then someone employed a needle to test the softness. (It is reported that in former days a No. 2 sewing machine needle was specified.) This expedient was, of course, a forerunner of the present penetrometer.

A second group of test methods has grown out of standard laboratory practices, such as fractionation by distillation and by determining the so-called solubility in certain solvents.

The majority of engineers have rather taken it for granted that all of these tests rest upon well-founded and proven bases. It would be illogical and unfair to be critical of the pioneers who devised our present standard laboratory procedures; they deserve every credit, but progress usually involves casualties in time-honored methods and viewpoints and we need not assume that the existing standards are sacred. Familiar things are usually taken at their face value without too much questioning or probing beneath the surface to understand the true significance or meaning. This tendency may account for the lack of realistic quality tests for asphalts. The real properties of materials and causes of certain phenomena are not always immediately evident and the investigator can take nothing for granted in trying to find "what causes a good asphalt pavement."

A CORRECTION

In the September-October issue of CALIFORNIA HIGHWAYS AND PUBLIC WORKS there appeared an article, "Results Obtained and Experiments Made in Asphalt Subsealing," authored jointly by H. L. Cooper, Assistant Maintenance Engineer, and W. R. Lovering, Associate Physical Testing Engineer. Through a typographical error, Mr. Lovering's name was spelled "Sovering" in the authors' byline. The article by Mr. Cooper and Mr. Lovering has attracted considerable attention in engineering circles.

SOME QUESTIONS

Before trying to develop quality tests it might be well to decide just what qualities *are* important. In other words, what must be expected of a paving asphalt? What is its function and what properties are essential and which unimportant?

To the chemist, asphalt is a mixture of hydrocarbons mutually dissolved and dispersed. To the highway engineer, asphalt is something used to stick particles of sand, gravel or crushed stone together in order to form a pavement which will withstand the abrasion of automobile tires, resist deformation under the weight of the vehicle, and withstand the deteriorating effects of rain and sun.

It was once thought that the stability of a pavement depended on the hardness of the asphalt, but as it has been widely demonstrated that stable surfaces can be constructed with practically any grade ranging from 20 penetration to an SC-2 road oil, and as all grades of asphalt have been found adequate to resist ravelling or abrasive action (provided proper proportions are used), it appears that *any adhesive semiliquid material which can be made sufficiently fluid to permit mixing with the aggregate, which will adhere well to the stone in the presence of water, and which will not become brittle with age, will make a suitable binder for a road surface;* and it does not matter whether it be asphalt, rubber, tar, or molasses, if it has these properties and is cheap enough.

Thus we can conclude that only four primary properties need be determined by testing, all others are irrelevant or comparatively unimportant. These properties are consistency, durability, rate of curing, and resistance to water action.

Consistency

The engineer must have some means for classifying bituminous materials of varying fluidity or hardness and for this purpose standard test methods are reasonably adequate. Undoubtedly, they can and will be improved. It would be desirable if all asphaltic materials could be compared on the same

numerical scale and it would be nice if we could deal in fundamental units and express viscosity in poises or centipoises. Nevertheless, this is a refinement and the problem of determining consistency is not clamoring for immediate solution.

It should be recognized, however, that consistency measurements may serve two purposes. First, the viscosity of the product must be taken into account in considering the type of construction operation. Road mixing, for example, is only feasible with the more liquid grades and is ordinarily impracticable with anything heavier than Grade 4 products of either slow, medium, or rapid curing types. In the plant mixing process consistency can be altered at will through the application of heat.

MATTER OF CONSISTENCY

Secondly, choice of a certain consistency depends upon conditions after construction. The character of the aggregate gradation may influence the designer in selecting consistency. For example, a Grade 2 liquid asphalt would not ordinarily be suitable for macadam aggregate and hard paving asphalts have many drawbacks when mixed with very fine materials. (The surface area of the aggregate should be taken into account when selecting the most appropriate grade of asphaltic binder.) A third consideration involves the permanence of the construction. For example, it is often desired that the bituminous surfacing be susceptible to reworking or reshaping at intervals and obviously only the more liquid asphalts should be used in such cases.

It may then be concluded that the consistency of asphaltic products is important under two quite distinct conditions and, therefore, under two different temperature ranges. It appears that serious attention should be given to the desirability of reporting consistency of all asphaltic materials at a temperature appropriate for mixing and construction operations and at a temperature typical of service conditions. It is recognized, of course, that actual working temperatures vary considerably. Nevertheless, it would be enlightening, for example, to indicate not only the consistency at a temperature between 70° F. and 100° F. but also at another point between 200° F. and 300° F.

Admitting that it is possible to distinguish between the various degrees of fluidity by using available testing equipment the next problem to be considered is whether or not the asphaltic material will retain its original properties and it is the ability of an asphalt to remain unchanged which determines the degree of durability.

Durability

Before discussing the durability of asphalts, it must be emphasized that all failures of bituminous pavements can not be charged to the asphaltic binder. There is a definite tendency for many engineers to blame any troubles on the asphalt or else to some vaguely inferred "chemical action." But before seeking to cure the ills of bituminous pavements by adjusting the properties of the asphalt, we must identify those troubles *for which the asphalt alone is responsible.*

A careful study of the types of distress which can be shown to occur with one asphalt and not with another of the same grade indicates that the most frequent and consistent difference to be observed is in cracking of the pavement, and or dusting and disintegrating of the surface from abrasion. Failures and deterioration of this type can be pretty broadly covered by recognizing that the asphaltic binder has become too hard or too brittle and has lost the properties of plasticity, ductility or malleability. Test procedures aimed at measuring durability have been of two general types. One group we may designate as typical of the chemist's approach while the other group represent physical tests which may require the use of mechanical devices.

LABORATORY OPERATIONS

Laboratory operations which involve the analytical procedures typical of the chemist's profession are the various solubility tests. For example, the solubility in CCl_4 and CS_2 undoubtedly have the general purpose of detecting asphalts which had been damaged by overheating in the process of manufacture and perhaps these tests are useful for the purpose.

In California experience, however, after testing many thousands of samples we have no record of a sample of commercial asphalt which failed to pass, but, nevertheless, we have received unsatisfactory asphalts. Furthermore, any sample which contains a percentage of mineral matter as in the case of most natural bitumens would not meet the standard requirements for solubility but a small amount of inert mineral matter can hardly be considered detrimental as filler dust is deliberately added as a component of most dense paving mixtures. These tests cannot be considered, then, as reliable indications of quality. (It is also obvious that the engineer should not be too greatly concerned with refining practices provided that the ultimate product is suitable for the purpose intended.)

SOLUBILITY RELATIONSHIPS

The solubility in petroleum ether and the various modifications of the Oliensis Spot Test are also attempts to classify asphalts by their so-called "solubility relationships." Whether or not this group of tests indicates the presence of asphaltenes or "heterogeneity" or whether they simply indicate something of the equilibrium of a colloidal system in the presence of organic fractions depends largely on the viewpoint and the background of the individual.

The second group of tests deals with the vapor pressure relationships and includes the flash test, the loss on heating, distillation, and the retention of consistency after a sample has been heated. All of these methods or analytical procedures have shown some correlation with performance and undoubtedly there are a number of measurable differences between a group of "good" asphalts and "poor" asphalts.

There is, however, one fatal weakness in virtually all these tests which is undoubtedly the principal reason for the lack of correlation which is known to exist. This is due to the incontrovertible fact that all of the test methods are performed on samples which are maintained in a fairly large bulk with a very limited area of exposed surface and for the most part evaporation and hardening tests are conducted at elevated temperatures. In contrast, asphalts in the pavement exist largely as films representing a vast surface area compared to the volume of asphalt and rarely are heated above 140° F. There is ample evidence to prove that hardening and changes in asphalt are largely a surface phenomena and marked differences have been reported due to variations in temperature and agitation in the presence or absence of oxygen.

There is no question that analytical methods have their value. Undoubtedly, they will continue to be used but the consumers and users of asphalts

are desperately in need of means which will detect durable asphalts from nondurable, irrespective of the reasons for the difference. As nondurable asphalts fail through becoming brittle and chalky and by losing their ability to resist pounding and abrasion it seems an obvious conclusion that durability tests should establish the existence or absence of these properties after the asphalt has been subjected to conditions typical of its service life. Such a durability test will be described later in this paper.

Rate of Curing

A third property of asphalt which is of concern to the consumer is the rate of curing of the more liquid products. These road oils and cutbacks have been logically classified as slow curing, medium curing, or rapid curing, and there are times and places where one or the other of these is most appropriate and definitely superior to the other alternates. Nevertheless, there is a considerable variation at times in products purchased under one of these designations. Materials have been delivered which met all of the test requirements for a slow-curing product and yet which were found to set up so rapidly that road mixing became difficult if not impossible.

On the other hand, rapid curing cutbacks have been specified and purchased under standard specifications but which were found to set up or cure no more rapidly than the medium-curing grades. It is clearly evident that existing specifications which undertake to control rate of curing by limitation of the distillation test are not adequate for the purpose and it seems reasonable to assume that failure to correlate is due to the marked difference between test conditions and temperature and those of service.

Again, in order to simulate service conditions, the asphalt must be spread in thin films and subjected to moderate temperatures and as curing obviously involves increasing viscosity or hardening of the asphalt, all that is necessary is to measure this change under appropriate conditions. A procedure for accomplishing this will be described later under the section devoted to recommended or proposed tests.

Resistance to Water Action

A fourth property of asphalts which will be of some concern to the user is the ability to adhere well to mineral aggregates and to resist stripping or separation by the action of water. It is not believed that asphalts ordinarily differ widely in this respect. It is generally known that the greatest variable exists in the mineral aggregates. Nevertheless, the user would like to know that an asphalt has at least the average capacity to stick in the presence of water.

The foregoing completes the summary and discussion of the essential properties of asphaltic materials so far as the user is concerned. Beyond a doubt the producer of asphalts may consider many other factors and conditions in manufacturing an asphalt which will meet quality tests. If tests can be established which deal only with essential properties, the purchaser and user of asphalts need not concern themselves with source, method of manufacture, or composition of the substance. In other words, if the material has the properties to make a good durable pavement, the consumer should not care who makes it or how or from what ingredients.

Research dealing with the above problems has been under way for some time in the California laboratory and is by no means completed and no implication is made that it is entirely original. If we have made any progress, we must acknowledge a considerable debt to all other effective workers in the field. The following will describe such progress and conclusions as have been made in answer to the four problems just outlined.

Consistency

Only a limited amount of work has been done on new methods of measuring viscosity or consistency. As previously mentioned, it is felt that this is the least acute and it is possible to get along quite well by the use of existing methods. It is believed that this phase of testing ultimately will be clarified by the adoption of true viscosity measurements applied to all grades ranging from 40 penetration to grade "O" liquid asphalt.

Interesting results have been secured by use of the Brookfield Synchro-lectric Viscosimeter. This apparatus is particularly attractive because of the possibility of measuring viscosity at a number of temperatures in a comparatively short time by a simple apparatus. However, the equipment should be modified and could doubtless be improved for routine work.

We are aware of the work by other laboratories using a modified Ostwald type of Viscosimeter(1) but the method appears too complex and time-consuming to be the ideal answer for a large consumer laboratory.

Durability Tests

The matter of durability has seemed to be the most pressing. A considerable amount of work has been carried out. Satisfying the conditions set forth in the previous discussion of the durability problem we have made numerous attempts to measure the behavior of asphalt in thin films. Two methods suggest themselves.

First, to spread the asphalt in a thin film over a plane surface, such as a glass or metal. Benson(5) developed a technique for spreading small smears on microscope slides and the success reported by Benson in classifying the films by microscopic examination after exposure to radiant energy tends to confirm the soundness of the belief that thin films are essential. We followed Benson's lead for some time and reached the conclusion that while informative and vastly interesting it, nevertheless, does not lend itself well to specification purposes. The patterns developed represented a too wide variety for easy classification.

Adopting the mechanical approach, similar smears were made on strips of thin sheet metal which after exposure to heat and light were subjected to abrupt bending and observed for cracking.

SECOND ALTERNATE

A second alternate was the use of thin films on circular tinned metal discs, such as lids of three-ounce ointment tins. After weathering, the film was subjected to sudden impact through the dropping of a steel ball on the reverse side of the tin. This produced a raised, rounded bump under the asphalt causing cracks in a brittle film and by making a series of these tests after a number of weathering cycles, it was possible to determine the effect of weathering in producing hardening. The primary difficulty was in establishing films of uniformly even thicknesses and it was quickly demonstrated that the resistance to shatter or cracking varied markedly depending on the thickness of the film. We were unable to devise

any means for spreading these films with absolute accuracy and uniformity over the entire surface. The method has definite possibilities if this difficulty can be overcome.

Another approach is to utilize a standard aggregate and this thought immediately brings to mind Ottawa sand. At this point in our investigation, the work reported by Lang and Thomas(3) came to hand and we immediately tried out certain of the methods described in this report. Three test procedures on Ottawa sand-asphalt specimens were reported by Lang. One, an elongation test, requires the manufacture of a special briquette which is pulled apart in a stretching device. The prospect of manufacturing these specimens as a routine operation was definitely unattractive; therefore, this operation was rejected.

LANG METHOD

A second method used by Lang with which we also experimented involves the manufacture of a briquette of Ottawa sand and asphalt which is destroyed by the impact of a hammer. This procedure has two definite weaknesses. One, the difficulty of detecting precisely when the first evidence of fracture has occurred. Second, the impossibility of ganging the weight of the blow. This means that a number of specimens must be tested involving a considerable amount of work, time and material.

The abrasion method however, has none of these limitations and as Lang's report seemed to indicate that the correlation by the abrasion method was at least as good as by any other, work was undertaken using the Deval machine as indicated by Lang. This was soon dropped in favor of a special tumbling device designed for the particular purpose. Many trials were made with generally gratifying results. It was clearly evident that very high losses were developed in specimens known to contain poor asphalts while relatively small losses were found with known good materials. Attempts were made to standardize and improve the reproductibility of results. However, while the test results were generally in the right order, it was found impossible to reproduce values on identical specimens as closely as could be desired.

Studying the problem further, the thought occurred that specimens could be subjected to abrasion by a stream of sand falling freely from a prescribed height. Simple trials were made and the method immediately indicated marked differences between briquettes manufactured from cracked asphalts as compared to good grades of steam-refined products. The difficulty in uniformly compacting a briquette one inch in depth and two inches in diameter lead to the adoption of a relatively thin specimen. The study has resolved itself to the method now in use.

This consists of preparing a mixture of Ottawa sand with 2 percent of the asphalt under test using a mixing temperature of 230° F. For the lower penetration grades, the lowest possible mixing temperature (above 230° F.) is used. (Mixing temperatures can, of course, be established as desired. For example, it may be most logical to use temperatures typical of paving plant practice for the particular asphalt.) Sufficient mix is prepared to make a number of 30 gram specimens which are compacted immediately in the form of small plaques using the lids of three-ounce ointment tins for the purpose. **(Figures 1A, 4 and 5)** These lids will hold approximately 30 grams of mixture when compacted level full. The samples are spread out in a flat pan and cured in a special weathering machine which employs an atmospheric temperature of 140° F. during which samples are exposed to the direct rays of standard drying lamps which emit the bulk of their energy in the infra-red band. A circulation of air is maintained. One complete cycle in this machine requires about five hours. The essential elements of this weathering operation could be produced very cheaply in a simple device built along the lines of the Weatherometer using radiant energy in the infra-red and a circulation of air.

TESTING APPARATUS

Two samples are tested immediately and others are removed from the curing ovens at intervals of three cycles and tested for abrasion loss under the impact of a stream of 10-14 mesh steel shot. The testing apparatus is so constructed that the specimen is rotated under a stream of shot falling freely through a tube 2½ cm. in diameter and 1 meter in length **(Figures 2 and 3)**. These dimensions are arbitrarily selected and are not necessarily the most ideal. Steel shot is allowed to fall at the rate of 1,800 grams per minute and the wear on the test specimen is expressed in grams lost per 1,000 grams of abrasive. A 10-14 mesh steel shot has been used because of its ready availability and ease with which it may be reclaimed after being mixed with the asphalt coated particles which are eroded from the specimen.

ABRASION TESTS NOT NEW

The use of this technique has proved to be the most satisfactory thus far considered and has the advantage of utilizing comparatively small quantities of materials for the test, specimens are easily prepared, large numbers can be handled in a weathering device of reasonable size, the tests are quickly made. Reproductibility is excellent and marked differentiation is shown between samples of known good and bad performance. Questions remaining to be finally settled are the appropriate temperatures for most significant results and the type and the development of a variable temperature laboratory mixer which will approximate the mixing conditions found in the field.

Abrasion tests or sand blast tests are not new. We have reports of a sand blast method used in Germany a number of years back and Rhodes of the Koppers Company(6) has reported favorably on the use of a sand blast device for measuring the durability of tar-sand specimens.

In adopting our present procedure it was felt that utilizing a gravitational fall would be much more simple and more easily controlled than the use of an air blast with the sand. In all cases we are strongly influenced by the consideration that to become a satisfactory routine method a test procedure should be as simple as possible, should preferably involve no expensive apparatus and be capable of being made in large numbers.

DEGREE OF WEATHERING

The principal drawback to this method is that a period of several days is involved as tests must be made after six or nine cycles of weathering in order to establish clear differences. The most satisfactory and significant degree of weathering is yet to be definitely fixed upon.

Figure 6 indicates the range of values developed by a series of asphalts ranging from good to poor based on service performance.

Figure 7 is a chart representing the durability rating of a series of

asphalts which represent straight run steam refined, cracked, also cracked and blown.

Figure 1 represents three plaques or test specimens of compacted Ottawa sand-asphalt mixtures weighing approximately 30 grams, compressed under 1,000 lbs. per square inch using the lid of a standard three-ounce gil ointment tin to hold the specimen.

Specimen A represents the specimen appearance as initially compacted showing no loss under sand abrasion. Specimen B is a specimen showing moderate loss. Specimen C indicates a considerable loss typical of an asphalt lacking in durability.

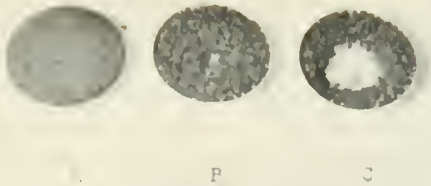
Figure 2 is a schematic diagram of the durability test apparatus for subjecting specimens (illustrated in Figure 1) to the abrasive action of sand falling through a tube one meter in length. Test specimen is rotated and entire system subject to temperature control.

Figure 3 is a photograph of the apparatus diagrammed in Figure 2.

Figure 4 shows the units used in preparing the durability test specimens.

Specimen A is the plunger or follower as commonly used in the Hubbard-Field Test, dia. 1.994 inches. Specimen B is a cylindrical steel mold 2 inches inside diameter. Specimen C is a lid of a standard three-ounce ointment tin, diameter 2-3 16 inches. Specimen D is a base plate with grooved recess to hold the tin lid. Specimen E is the funnel for introducing Ottawa sand-asphalt mixture.

Figure 5 is the same as Figure 4, showing apparatus assembled, ready for applying compression load of 3,500 pounds total (i. e. 1,000 lbs. per square inch).



B C

Figure 1



Figure 2



Figure 3



A B C D

Figure 4



Figure 5

Table I gives detail of other test data. While no service record is available it is believed, however, that the data are significant as the durability test shows all steam refined asphalts to have low loss and, hence, good durability, while cracked asphalts show an increased susceptibility to abrasion loss and cracking plus blowing is apparently even more detrimental. It will also be noted that the Mid Continent crudes may not be adversely affected by a certain degree of cracking if not carried too far.

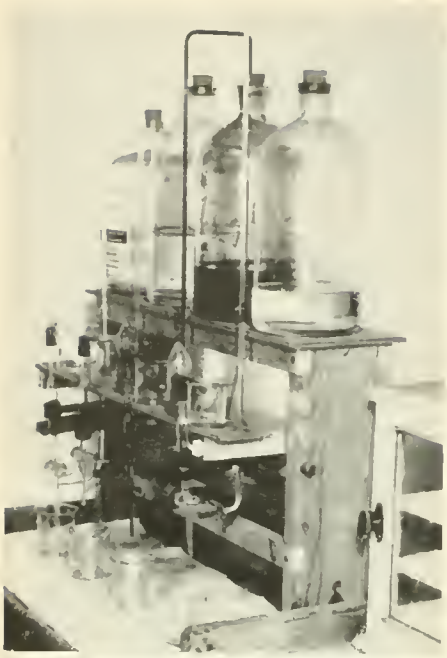
MECHANISM OF HARDENING

Figure 9 represents durability results on seven samples of SC oils from the State of Wisconsin all of which met Standard Specification requirements according to Mr. Zapata. He advises that No. 1 and No. 7 have given poor service. Figure 9 indicates the poor quality of No. 7 while Figure 21 seems to account for No. 1.

A test of this type does not carry any particular implication or produce direct evidence as to the mechanism of hardening. It has been variously maintained that the hardening of asphalts is due primarily to the loss of volatiles(2). Others contend that oxidation is a primary factor. Polymerization and thixotropy have been mentioned and no one can question that all of these mechanisms may play a part. Oxidation tests such as the Kansas City Testing Laboratory Oxidation(11), as well as those reported by Nicholson(7) and Skidmore(8), Raaschig and Doyle(9), Anderson, Stross and Ellings(10), all have shown a considerable degree of correlation with performance.

Even though hardening may develop through several types of mechanism, there seems to be good reason for finding out something about the capacity of an asphalt to take up oxygen and it appears unquestioned that if an asphalt will combine with any appreciable quantity of oxygen, its physical characteristics will be changed.

Working in the California Laboratory, Mr. A. R. Ebberts devised a technique for quantitative measurement of the relative oxidation of asphalt in thin films(4). Details of this method have been previously reported but



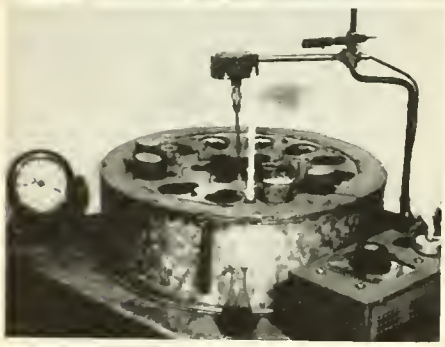


Figure 10. An automatic pipe the lay-out for dispensing re-agents. Figure 11. The water bath maintained at 140 degrees Fahrenheit for the conditioning of specimens.

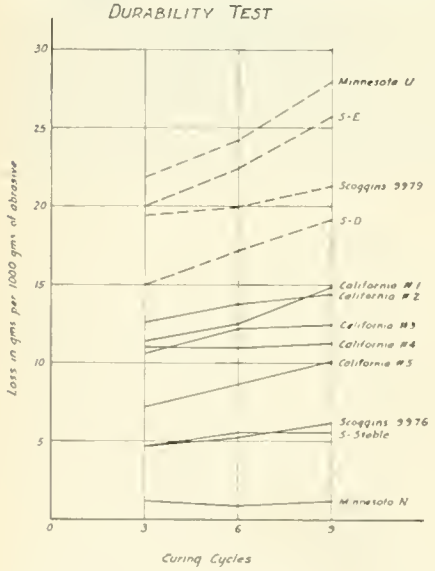


Figure 6 is a chart showing abrasion loss on 13 samples of asphaltic materials which have given previous indications of quality either in service or by extensive laboratory investigations. Samples N and U, furnished by the Minnesota Department of Highways, were previously reported by Lang and Thomas.[3] Samples marked S-stable, S-D and S-E furnished by Mr. V. A. Endersby of the Shell Development Company, were classified as follows:

S-stable, carefully refined asphalt found to be durable on field experiments; Samples S-D and S-E were cracked to varying degrees; and S-E was found to be very unstable and ravelled badly on the street under moderate traffic. Samples Nos. 9976 and 9979 were furnished by B. I. Scoggin of the Anderson-Prichard Oil Corporation. Sample No. 9976 was reported as showing excellent performance in pavements over 11 years old. Sample No. 9979 was a product of a Winkler Koch cracking unit and has not proved to be satisfactory in service.

The samples marked California No. 1, 2, 3, 4, 5 are typical California 85-100 penetration asphalts manufactured from various California crude oil sources.

modifications have been made and at present details of the test procedure are being studied in order to make it possible to obtain satisfactory reproducibility between operators.

There is some evidence that satisfactory asphalts should have neither too great nor too little capacity to combine with oxygen. Furthermore, the oxygen demand evidently varies with

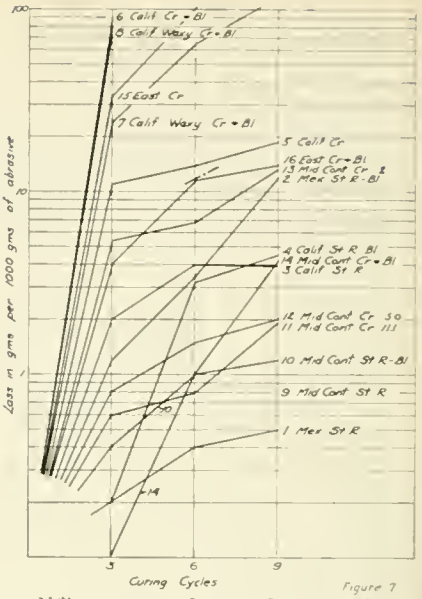


Figure 7

the different grades and a consistent increase may be traced from the heavier paving grades to the most liquid materials. For example, it appears that satisfactory asphalts of 50 penetration should consume not less than 0.9 ml. nor more than 1.2 ml. of $KMnO_4$

TABLE I

A	B	C	D	E	F	G	H	I	J	K
Sample No.	Source of Crude	Str. Run	Cracked	Blown	A.P.I.	Pen.	Sft. Pt. Ring & Ball	Susceptibility Index	Ebberts Oxid.	Abrasion
1	Mexican	x				103	119 5	2	4	1
2	"	x		x		100	144	1	8	9
3	Calif. Lube	x				97	110	15	5	7
4	"	x		x		94	112	10	3	8
5	"		x			108	108	16	9	12
6	"		x	x		107	110	9	15-16	15
7	Calif. Waxy		x	x		92	112 5	8	14	13
8	"		x	x		100	113	5	15-16	16
9	Mid-Cont.	x				103	112	7	1	2
10	"	x		x		84	118	3	2	3
11	"		x		11 1	108	109 5	12	6	4
12	"		x		5 3	92	112	13	7	5
13	"		x		2	96	111	12-13	10	
14	"		x	x	5 3	92	116	4	10	6
15	Eastern		x			105	110	11	12-13	14
16	"		x	x		86	115 5	6	11	11

The above table lists certain data on 16 samples of asphalts representing different crude sources and different methods of treatment in the refinery. Column B indicates source of crude, Columns C, D, and E indicate the refinery process, and columns F, G, H, and I indicate A.P.I. Gravity, Penetration, Softening Point, and Susceptibility Index (according to Piper and Van Doormal). Column J indicates the relative order of quality as indicated by the Ebberts Oxidation Test. Column K indicates the relative order of quality indicated by the Durability test at 6 cycles as shown on Figure 7.

in 60 minutes at a temperature of 140° F. under the conditions described; whereas, an asphalt of 200 penetration should range between 1.0

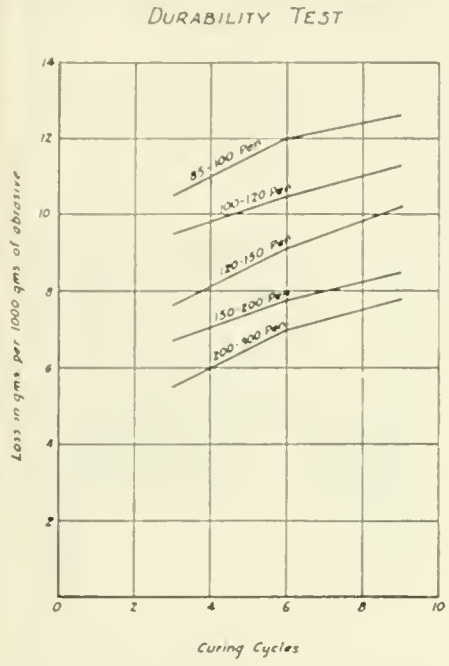


Figure 8 is a chart showing the differences in abrasion losses between five grades of California paving asphalts all refined from the same crude oil source.

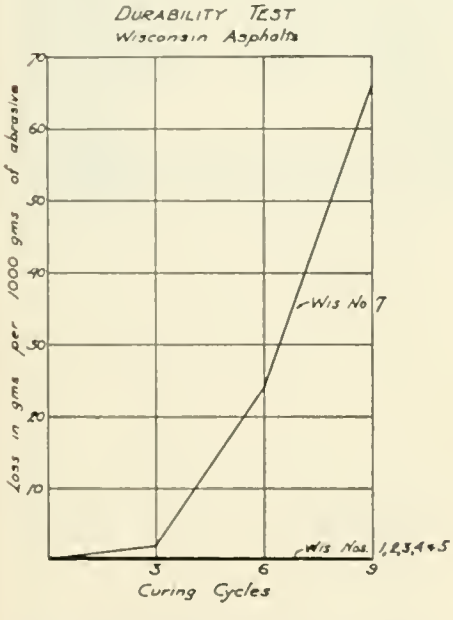


Figure 9 is a chart of abrasion losses displayed by seven samples of slow-curing oil furnished by Mr. Joseph Zapata of the Wisconsin Highway Department. Mr. Zapata reports that all samples have met standard specification requirements, however, samples No. 1 and No. 7 were found to be unsatisfactory in service. Figure 9 seems to indicate the reasons for the failure of sample No. 7. The deficiencies of sample No. 1 are at least partially indicated by Figure 20.

ml. and 1.7 ml. In a similar manner tentative limits have been established based on the existing data which involves tests performed on some 10 or 50 samples in each of several grades. Data thus far available establish a tentative rate of change relationship between the paving grades and the SC products. Sufficient study has not been completed on the MC and RC types.

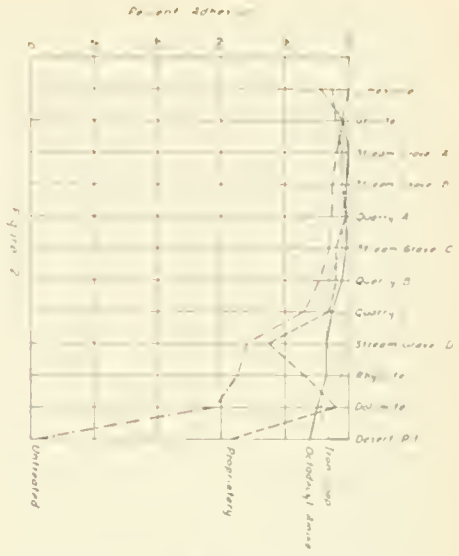
It does not necessarily follow that this particular test will show 100 percent correlation with road performance but it offers attractive possibilities for the immediate and rapid classification of asphalts as the method will produce an answer within a few hours after the sample is received and requires relatively simple and inexpensive equipment.

As previously reported, there is a consistent and considerable difference between the oxidation capacity of SC-1 and SC-6 and it seems inescapable that the presence of the more volatile fractions permits a greater consumption of oxygen. Whether it is the volatiles which take up the oxygen or merely facilitate its consumption is not at present known. Probably two factors in the asphalt composition bear on the susceptibility to oxidation. These are the size and the nature of the molecules. The capacity to consume oxygen increases with the percentage of the more volatile fractions and there is no doubt that it also varies with the percentages of aromatic and paraffinic types of molecules. The total values in the oxidation test, then represent some sort of compromise between molecular size and type making it necessary to set up a standard for each liquid grade or penetration range.

At the present time this oxidation test appears to have considerable degree of significance, although not necessarily capable of detecting every potentially poor asphalt. The fact that it is quantitative, comparatively simple and capable of producing rapid results seems to justify further work in the hope of developing a satisfactory technique for routine operation.

Tests for Determining Rate of Curing

Rate of curing becomes important when dealing with Grades 1, 2, 3 and 4. Serious damage can result if an alleged SC product sets too rapidly or an RC cutback fails to set up as expected. Existing distillation tests, while generally indicating the difference, nevertheless, permit too much variation and, furthermore, are conducted at elevated temperatures far beyond the range of service conditions.



The effect of various wetting agents as assessed by the dye adsorption technique is shown graphically in Figure 12. An adhesion of about eighty-five per cent (85%) is necessary to assure satisfactory service life. These agents seem to be most effective when the aggregate is damp at the time of mixing. The mixtures were all made with SC-3 oil.

A method developed in the California laboratory seems to need little further improvement to supply an adequate answer to this problem. The test is performed as follows: 2 percent by weight of liquid asphalt is mixed with Ottawa sand in the same manner as prescribed for the durability test. The test requires some 160 grams of mixture. Immediately after mixing, this coated sand is pressed by hand trowel into a small metal mold in the form of a trough, having a semicircular cross-section with a radius of .687 inch and a length of 9 inches. This mold is then placed in a specially designed apparatus housed in a cabinet permitting accurate temperature control **(Figure 13)**. The beam of asphalt is pushed or extruded from the mold in a horizontal position **(Figures 14 and 15)**. The unsupported overhanging end of the small beam will bend and break off under its own weight as soon as a sufficient length has been extruded **(Figures 16 and 17)**. The mold travels at a uniform speed of six inches per minute with temperature of all metal parts and enclosed atmosphere maintained at 100° F.

These breaks will occur at intervals varying in length depending on the consistency of the asphalt. For example, a freshly mixed SC-2 will produce breaks at intervals of about .3 inch **(Figure 18)**, whereas, MC and RC products may range from .6 inch to .9

inch initially (**Figure 19**). After testing the freshly formed mixture, the sample is retrieved and spread in a flat pan to a depth of approximately one-fourth inch and subjected to three cycles (16 hours) in the accelerated weathering oven. It is then removed, reformed in the mold and again tested. This operation may be repeated as many times as desired, however, it appears evident that after the first three cycles (namely, after one night's exposure in the weathering machine), the essential curing characteristics may be identified by the slope of the curve as shown in **Figure 19**.

Figure 19 also shows that a clear distinction is evident between the various grades of SC, MC and RC products as produced by a major company, which so far as field experience is concerned appear to act in the manner expected. However, samples have been made available representing products which were reported to fail completely in setting up properly in service and these samples have unmistakably shown this tendency by the virtually unchanging length of break developed in the machine, regardless of the number of curing cycles (**Figure 20**). The instrument has been devised to be self-recording so that the length of break is unmistakably marked on a paper strip permitting the averages to be determined (**Figures 17 and 18**).

Surprising uniformity has been secured, although occasional increments may run out of line. It should be possible to prevent these occasional discrepancies, however, they are not serious as the large number of breaks makes it possible to virtually eliminate errors by averaging the individual lengths. To all intents and purposes this particular machine produces from six to 20 test results on each specimen in the short space of a few minutes (**Figure 18**).

As in all studies for significant qualities of asphalts, material with a known record of poor performance are difficult to secure and proof of the significance of the tests must of necessity rest on a rather limited number of samples. California practice makes occasional use of RC cutbacks to supply cohesion in fine sands of low internal friction. This expedient has been quite useful when stable aggregates are not readily available.

On a recent project, however, the material failed to harden or set up as had been expected in previous cases. A careful recheck of the cutback indicated that it was well within specification requirements in all respects. When subjected to this curing test, however, it was found to perform definitely below the general run of such material; in fact, it gave almost the same indications as an MC product. Results of the test were in excellent agreement with observed performance. **Figure 21** shows several samples which fail to cure at the normal rate.

This particular procedure appears to be in little need of further modification or drastic improvement and can be strongly recommended in its present form. Several changes in the mechanical equipment could be made without altering the principle. For example, the slide should be actuated by a synchronous motor operating through a reduction gear to produce

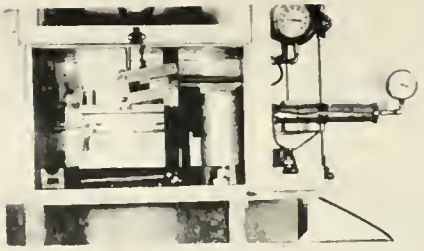


Figure 13

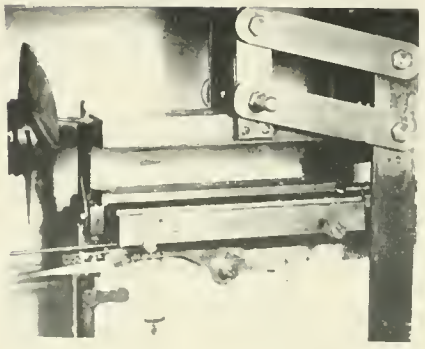


Figure 14

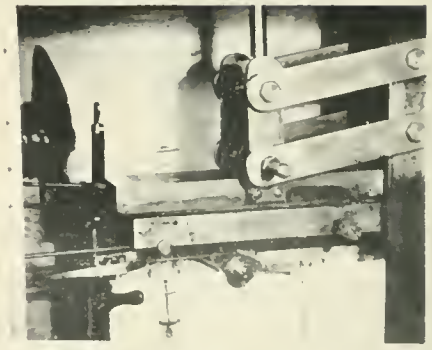


Figure 15

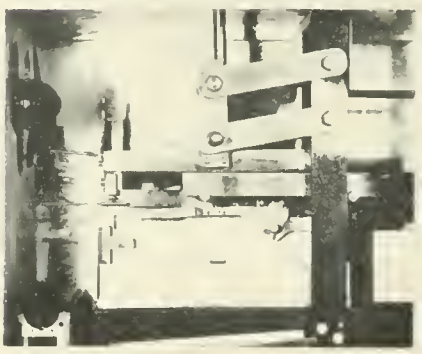


Figure 16

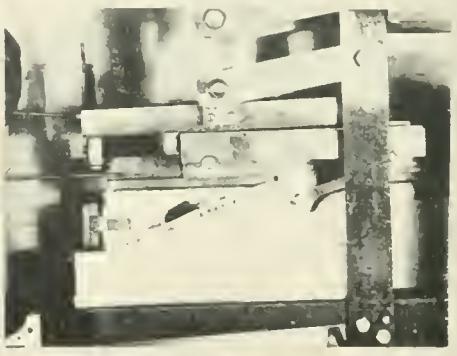


Figure 17

Figure 13 is a general view of cabinet and apoaratus for performing curing test by extruding a beam of compacted Ottawa sand-asphalt mixture by noting the tensile strength as evidenced by the lengths of increments which are broken by their own weight.

Figure 14 is a close-up view showing specimen in place with heavy metal cover suspended to permit insertion of semi-circular mold.

Figure 15 shows metal cover lowered to rest on upper surface of test beam.

Figure 16 represents test under way showing lower member being retracted to the right. End of asphalt beam may be seen drooping beneath the cover plate.

Figure 17 shows increment broken off and depressing recorder arm which inscribes a mark on paper strip. The distance between marks indicates lengths of broken increments. (See Figure 18 for facsimile of record strip.)

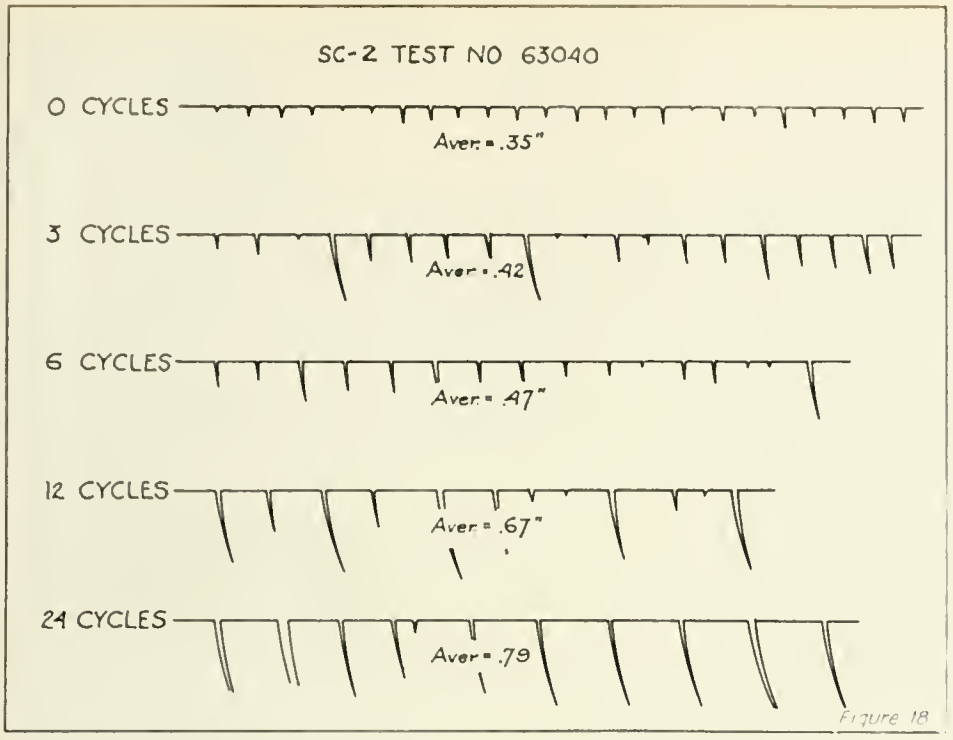


Figure 18

the desired speed. While a hydraulic cylinder was used in the original machine to permit ready variation of speed, this type of drive will not be satisfactory for routine control after a standard speed has been agreed upon.

Thus we have two methods, both dealing with the asphalt spread in films over the surfaces of aggregate particles and subjected to the hardening influences of radiant energy and oxygen. The methods are simple and direct.

Resistance to Water Action

The fourth property of asphalts concerns the resistance to water action. While tests for this type of failure have been in use since 1929 in the form of swell tests and stripping tests, there is still much to be desired in the way of correlation with actual performance. While these tests so far have generally been used to classify the mineral aggregates there is no doubt that asphalts also vary somewhat in their ability to adhere in the presence of moisture.

Work has been under way in the California laboratory for some time seeking to develop a quantitative measure of stripping. This work is based on the known fact that most surfaces will adsorb dyes of various types and by selecting a suitable dye it was hoped that the amount of stripped surface could be accurately measured. The procedure followed consists of, first, determining the dye adsorption of the untreated aggregate. For this purpose the entire material is used ranging from four-mesh to and including the dust. This constitutes a definite improvement over the standard stripping test as the smaller sizes are generally the most important due to the large surface area represented. The aggregate is then coated with a standard grade of asphalt and after curing over night it is subjected to the stripping test. Dye is then added and the adsorption again determined.

PERCENTAGE OF STRIPPED AREA

By comparing the amount of dye adsorbed after the stripping test has been performed to the amount taken up by the entire aggregate before being coated with asphalt, it is possible to determine the percentage of stripped area. This type of determination has shown good reproducibility but requires the attention and time of an operator who is well-trained in the techniques employed. The method cannot be recommended or advocated in its present state as a routine operation but does provide a means for obtaining comparative data on adhesion phenomena.

If a dependable method can be devised which will show good correlation with field performance, it might then be possible to classify asphalts by using some standard aggregate

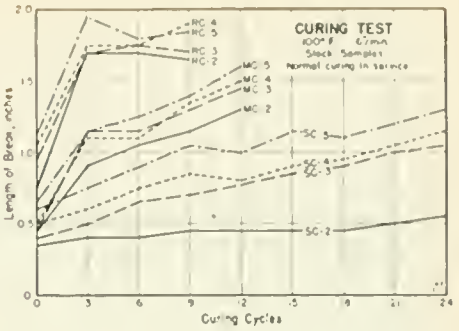


Figure 19 is a chart showing relative behavior of liquid asphalts in the curing test after a varying number of cycles of curing. These products have all given normal performance in service so far as rate of curing and final consistency is concerned. The chart indicates that curing characteristics may be identified after only three cycles of accelerated curing. While minor discrepancies exist, the pattern of behavior for slow curing, medium curing, and rapid curing are distinctive and the several grades fall approximately in normal sequence.

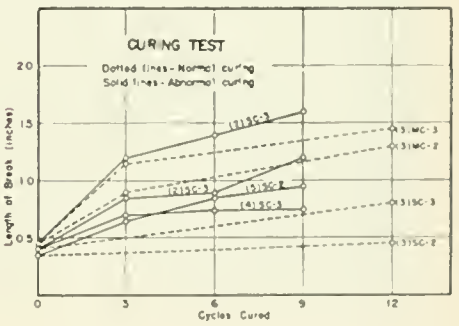


Figure 20. A chart showing several oils wherein the curing characteristics are at marked variance with the normal for the grade. The dotted lines indicate normal curing behavior for the grades indicated. The solid lines show the rate of curing of certain products which have been observed to perform in an erratic manner during construction operations. These test data seem to be in good agreement with observed performance.

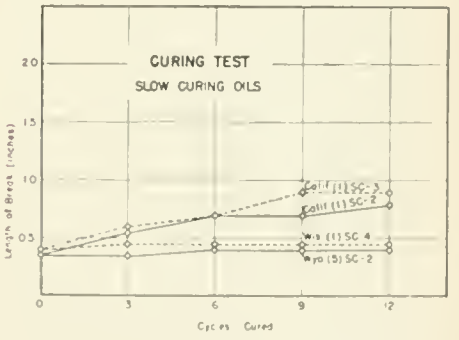


Figure 21. This chart illustrates the difference in test results between slow curing and non-curing samples. Wisconsin No. 1 and Wyoming No. 5 were reported as failing to set up or harden on the road. Two California oils which have shown normal curing are included for comparison.

for the purpose. It is to be feared that adhesion tension relationships between asphalts and aggregates may be specific rather than general and if this proves to be the case, the classification of asphalts by means of a single standard aggregate would not be very useful. At present, it appears necessary to use several aggregates of varying composition in order to get a fairly reliable picture of the ability of asphalt to stick.

A complete solution to this entire problem may readily appear from another source. There are now many methods of treatment being advocated or in process of development which should improve the capacity of any asphalt to stick to virtually all aggregates under the most adverse conditions. When an agent is commercially available which can be added to the asphalt at the refinery, this entire problem may largely disappear, although it is likely that accurate test methods will always be needed in order to compare the effectiveness of competing forms of treatment and to assure ourselves that the wetting agent is actually present in specified quantities in the delivered material.

At the present time, three experimental projects are being constructed at selected points in Districts II, VIII and XI, in order to observe the effectiveness of several additives under actual roadway conditions. However, final conclusions cannot be drawn for some time.

RECOMMENDATIONS

With perfection and further corroboration of the results indicated in the foregoing, the next step would be the inclusion of such quality tests in all Standard Specifications. It is suggested that a typical specification would consist of limitations on the flash point corresponding to present practice, specifications for viscosity or penetration and maximum percentage of water. It would then appear to be in order to discard all requirements dealing with distillation, residue of 100 penetration, tests on the residue from distillation and solubility of CCl_4 and CS_2, as well as the xylene equivalent or spot test. In addition, the tests for paving asphalt, loss on heating for five hours at 325° F. and penetration after loss on heating could also be dropped.

In lieu of these requirements, limits of performance under the curing test would indicate a maximum and minimum rate of change for all grades of liquid asphalt. This would serve in lieu of the distillation procedure. Tests for durability would be included, also the test to indicate oxygen demand. It is believed that with the adoption of tests of this type or modifications thereof that the process of selecting suitable bituminous binders would be much simplified and would be in some respects less restrictive than present specifications, but on the other hand would be far more positive in rejecting definitely unsuitable materials.

Evidence thus far available indicates that when judged by these determinations all cracked products are not necessarily objectionable. It appears that a great deal depends on the degree and extent of the cracking and a moderate amount may even be beneficial. This would seem to be in line with reported experience, particularly from the Middle West.

The point should again be emphasized that properly coordinated tests will permit the acceptance of all materials which are capable of producing satisfactory construction and would eliminate all which are unsuitable for the purpose and that having such test procedures the purchaser need not be concerned with either source of material or method of manufacture. The problem of manufacturing a binder or cementing agent which will meet these requirements is up to the producer.

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San Francisco-Oakland Bay Bridge Completes Ten Years

(Continued from page 6)

output would necessarily have been curtailed—all at the expense of the war effort.

On its tenth anniversary the San Francisco-Oakland Bay Bridge is experiencing a traffic volume rapidly approaching maximum capacity. Studies for a new crossing are now being made under the general supervision of Director of Public Works Purcell and Chief Engineer of the San Francisco-Oakland Bridge, with F. W. Panhorst, Bridge Engineer of the California Division of Highways, in direct charge.

In "Engineering Facts," a study for the California Legislature, by the staff of the Collier-Joint Fact-Finding Committee on Highways, Streets and Bridges, we read:

> "When the San Francisco-Oakland Bay Bridge was opened to traffic on November 12, 1936, it was hailed as an engineering wonder of the age, the solution of transbay transportation problems for years to come. Today, only 10 years later, its traffic is so heavy that another bay crossing is under consideration to meet present and future needs."



This road when completed will carry to market millions of board feet of sorely needed lumber

Mosquito Ridge National Forest Road Will Relieve Lumber Shortage

IN MAY of this year the Mosquito Ridge Forest Highway, Route 96, was approved as an addition to the California Forest Highway System following joint recommendation to that effect by the Regional Forester, State Highway Engineer, and Division Engineer of Public Roads Administration. The route extends from Forest Hill, a small lumbering settlement 20 miles east of Auburn, easterly for 19.2 miles to a point on Mosquito Ridge about 20 air-line miles westerly from Lake Tahoe.

For some years the U. S. Forest Service has planned ultimate development of the extensive stands of Government-owned merchantable timber in the Mosquito Ridge and adjacent Ralston Divide areas of Tahoe and Eldorado National Forests, and early in 1945 the regional forester requested that Public Roads Administration make surveys of both the Mosquito Ridge Road and the connecting Ralston Divide Route.

The acute shortage of lumber for needed housing at the war's end made it necessary that plans for development of timber be accelerated. Accordingly, early in 1946 studies of available timber in the Mosquito Ridge and Ralston Divide areas were completed by the Forest Service. These studies indicated that sufficient timber to support a continuous extensive lumbering operation can be obtained from the areas. Since one of the chief functions of forest highways is development of National Forests it was recommended immediately that the Mosquito Ridge Route be added to the Forest Highway System and that funds made available for forest highway construction by the Federal Highway Act of 1944 be programmed for construction. No cutting of timber in the Ralston Divide area is planned for a number of years and, therefore, construction of that road will be deferred.

Completed design for the Mosquito Ridge Route provides a 22-foot roadbed for the first 9.5 miles with a single lane road 12 feet wide with intervisible turnouts on the remainder. There are only two major structures on the entire length, a reinforced concrete arch cul-

(Continued on Page 37)

Traffic Engineer Looks at the Current Traffic Accident Problem

By J. W. VICKREY, Traffic Engineer

ACCORDING to the reports of the National Safety Council, California's traffic fatality record for the first nine months of 1946 shows 10.4 fatalities per 100,000,000 miles of motor vehicle travel.

Compared with the 1945 record of 15.3, this report shows considerable improvement and it offers encouragement and support to the hope of everyone whose daily life is affected by motor transport that we may be able to squeeze through the year with a much smaller toll of life than was predicted during the late spring and early summer.

The record for the portion of the State Highway System outside of incorporated cities for the first nine months of the year, compared with a like period in 1945, shows that fatalities have increased 29 percent while motor vehicle traffic has gone up 46 percent. Making a comparison with the first nine months of 1941, fatalities and traffic have increased 13 and 24 percent respectively.

While it is a cold fact that there have been more persons killed in motor vehicle traffic accidents thus far during 1946 than for a like period in any recent year, we have reason to be encouraged that at least the rate or trend line for 1946 shows some improvement.

The bringing about of improvement in the traffic accident problem is a difficult and complex undertaking. Even maintaining reduced fatality rates already achieved, requires constantly increasing effort because the conditions which cause traffic accidents are more widespread and more frequent with expanding motor transport. General recognition and acceptance of this fact is apparent from the widespread interest manifest in the President's Safety Conference and the conferences called by the Governor of California and the action of Interim Legislative Committees.

In order to take proper measure of the magnitude and importance of the traffic accident problem, it is necessary to turn to accurately compiled motor traffic data.

These data, through traffic and traffic accident analysis, provide not only the one sound basis by which the traffic accident problem may be measured but they also, and of equal if not greater importance, supply the only basis by which proper remedial action may be formulated.

Adequate traffic accident reports analyzed by competent and experienced analysts, of which there are all too few, form the single basis from which remedial measures that have any hope of success may be planned and put into action. It is regrettable that the whole traffic accident problem is made more complex, and its improvement more difficult and further away, by the suggestion of so many panaceas and palliatives that have no base or foundation that can be supported by an analysis of factual data.

Traffic accident reports competently analyzed and interpreted, bring out concentrations of locations and types that point the way to remedial action. Eighty-six percent of the traffic accidents reported on the State Highway System outside of incorporated cities occur on 38 percent of the mileage or on about 4,700 miles.

This same 4,700 miles carries 81 percent of rural state highway traffic and it comprises the portion of the system which carries 1,500 or more vehicles per day. About 12 percent of the system, or some 1,600 miles, carries an average daily traffic of 4,000 and over vehicles. This small portion of the mileage accounts for almost 60 percent of the traffic accidents. This is substantially the mileage that should be expanded to more than two lanes in order to safely accommodate the present vehicle load.

It is very evident from these figures that insofar as rural highways are concerned the traffic accident problem is actually concentrated on a very small portion of the system. A large portion of the mileage, some 7,500 miles, does not show any concentration of accidents in general pattern. There is ample reason to believe that this same concentration of the majority of traffic accidents on a reasonably small mileage prevails on the entire road and street system of the State.

An analysis of all the traffic accidents that were reported as occurring on the rural State Highway System during the year 1945 in which persons were killed, shows that in about 50 percent of these situations some type of highway improvement is indicated as a remedy for preventing that particular type of accident. At the same time this same study shows that HBD (had been drinking) was a factor in 27 percent of the accidents.

All fair and impartial analyses of traffic accidents show up drinking as one of the principal contributing factors. HBD drivers and HBD pedestrians take an all too important part in the traffic accident problem. This is the outstanding contributing cause to traffic accidents, with which society should deal with quick and decisive results. It is a job for society at large.

There is little that enforcement can do with this particular part of the problem but compile the accident reports, and there is little that the engineer can do but point out the facts. The fact cannot be denied that in the failure to recognize and solve this particular accident problem is reflected the true attitude of the general public toward traffic accidents.

On the other hand, the 50 percent of fatal accident reports that indicate some type of highway improvement as a remedy, reflect a part of the problem that can be to large extent solved by improved highway facilities and to a considerable degree minimized by selective enforcement. It all costs money—but it will cost more to continue with the present conditions than it will cost to improve them.

There is ample reason to support the belief that through the application of techniques already known the fatality rate of 10.4 per 100,000,000 miles of motor vehicle travel can be reduced by at least one half. A program to put such procedure into effect will cost large sums of money but it will be worth it.

RURAL STATE HIGHWAY ACCIDENTS

				Percentage Change 1946 over 1941		Percentage Change 1946 over 1945	
January	1941	1945	1946	Accidents	Traffic	Accidents	Traffic
Fatal	75	61	100	33.3	---	63.9	---
Non-Fatal	643	494	909	41.4	---	84.0	---
P. D. O.	478	307	657	37.4	---	114.0	---
Total	1,196	862	1,666	39.3	38.6	93.3	45.8
February							
Fatal	68	61	109	60.3	---	78.7	---
Non-Fatal	647	407	833	28.7	---	104.7	---
P. D. O.	495	271	621	25.5	---	129.2	---
Total	1,210	739	1,563	29.2	36.7	111.5	52.0
March							
Fatal	69	81	109	58.0	---	34.6	---
Non-Fatal	610	422	875	43.4	---	107.3	---
P. D. O.	489	352	704	44.0	---	100.0	---
Total	1,168	855	1,688	44.5	24.8	97.4	48.7
April							
Fatal	87	62	86	1.1	---	38.7	---
Non-Fatal	619	434	770	24.4	---	77.4	---
P. D. O.	494	308	592	19.8	---	92.2	---
Total	1,200	804	1,448	20.7	28.1	80.0	54.8
May							
Fatal	80	52	81	1.3	---	55.8	---
Non-Fatal	735	463	819	11.4	---	76.9	---
P. D. O.	589	320	637	8.2	---	99.1	---
Total	1,404	835	1,537	9.5	24.2	84.1	51.7
June							
Fatal	88	77	84	4.5	---	9.1	---
Non-Fatal	741	490	781	5.3	---	59.4	---
P. D. O.	478	380	663	38.7	---	74.5	---
Total	1,307	947	1,528	16.9	21.2	61.4	59.2
July							
Fatal	100	77	93	7.0	---	20.8	---
Non-Fatal	888	601	887	0.1	---	47.6	---
P. D. O.	664	408	652	1.8	---	59.8	---
Total	1,652	1,086	1,632	1.2	22.1	50.3	50.0
August							
Fatal	99	102	97	2.0	---	4.9	---
Non-Fatal	903	801	931	3.1	---	16.2	---
P. D. O.	728	542	726	0.3	---	33.9	---
Total	1,730	1,445	1,754	1.4	14.1	21.4	49.3
September							
Fatal	93	96	101	8.6	---	5.2	---
Non-Fatal	813	913	881	8.4	---	3.5	---
P. D. O.	647	647	810	25.2	---	25.2	---
Total	1,553	1,656	1,792	15.4	19.2	8.2	16.7
January through September, 1946							
Fatal	759	669	860	13.3	---	28.6	---
Non-Fatal	6,599	5,025	7,686	16.5	---	53.0	---
P. D. O.	5,062	3,535	6,062	19.8	---	71.5	---
Total	12,420	9,229	14,608	17.6	24.4	58.3	46.1

New Fresno Freeway Does Away With Congested Section of U. S. Highway 99

By R. S. PERCIVAL, Associate Highway Engineer

With the opening to traffic of the Fresno Freeway in October, a seriously congested section of US 99 at the southerly approach to the City of Fresno has been eliminated. The improvement is on new alignment and is, in general, about 600 feet westerly of the original highway between the Calwa Overpass and the south city limit of Fresno at Church Avenue.

The average daily traffic on this two-mile section, based on the July, 1946 counts, is 19,000 vehicles at the southerly end and 22,000 vehicles at the northerly end. Because of the extensive commercial development along Railroad Avenue, which was the former State Highway, it was determined that it would be more economical to relocate the highway than to widen the existing one. A further advantage of the relocation is that a wide right of way could be acquired at a reasonable cost, which would provide ample room for road connections with wide flares for good turning radii, and traffic islands and speed change lanes for the better protection of traffic. The former route was not susceptible to these advantages because of the very short distance between the edge of pavement and the railroad tracks.

Plans for this project were completed in 1943 and funds were allocated for construction; however, because of the critical shortage of materials and manpower, the work was deferred for the duration of the war. With the cessation of hostilities, this project was advertised for construction. Work was begun in January, 1946, and is scheduled to be completed the later part of November.

The work as completed is the first stage in making this section of State Highway Route 4 (U. S. 99), in and adjacent to Fresno, a freeway. Present construction provides a four-lane, divided highway on 200 feet of right of way with grade crossings at the existing county roads, but with no direct access to the freeway allowed to abutting property owners. The distance between the northbound and southbound pavements is thirty-two feet. The final stage of the work, to be completed when traffic demands require it, will involve the construction of grade separation structures at some of the intersecting roads and the closing of others, with outer highways being provided where needed to connect intersecting roads. In its ultimate stage, the freeway will have no crossings at grade but will be provided with on-and-off ramps adjacent to grade separation structures.

The pavement consists of two lanes of Portland cement concrete eight inches thick and twenty-three feet wide, with plant-mixed surfacing borders and bituminous treated shoulders. The more important intersections have been channelized with traffic islands and speed change lanes.

The concrete pavement was constructed without expansion joints and with weakened plane joints at fifteen-foot intervals. The weakened plane joints were cut with a diamond saw the day after pouring the concrete. The cutting machine used for this purpose is a device having rotary cutters faced with diamond chips. It is mounted on a two-axle, six-tired-wheel, frame, which can be steered longitudinally along the pavement slab. The cutting beam is mounted transversely and holds six cutting discs. These are spaced twenty-four inches apart and thus can cut a slab twelve feet in width to a depth of 1¼ inches with a two-foot movement of the cutting beam. The machine is operated by one man from a platform above the cutting beam which he controls hydraulically. The time required to cut each joint is about two minutes and each disc will cut about 1600 linear feet of concrete to the depth required for weakened plane joints. Tie bolts at thirty-inch centers were used in the longitudinal joint between the 11-foot and 12-foot slabs and in transverse construction joints. Adjacent slabs were also keyed to each other by attaching a key strip to the metal side form of the first slab to be poured in each pavement.

The concrete slab was laid on a three-inch bituminous treated base. This material consisted of imported borrow mixed with RC-3 at a central mixing plant and was spread with a Lakewood Finisher after the subgrade had been cut with a Lewis Subgrader and compacted.

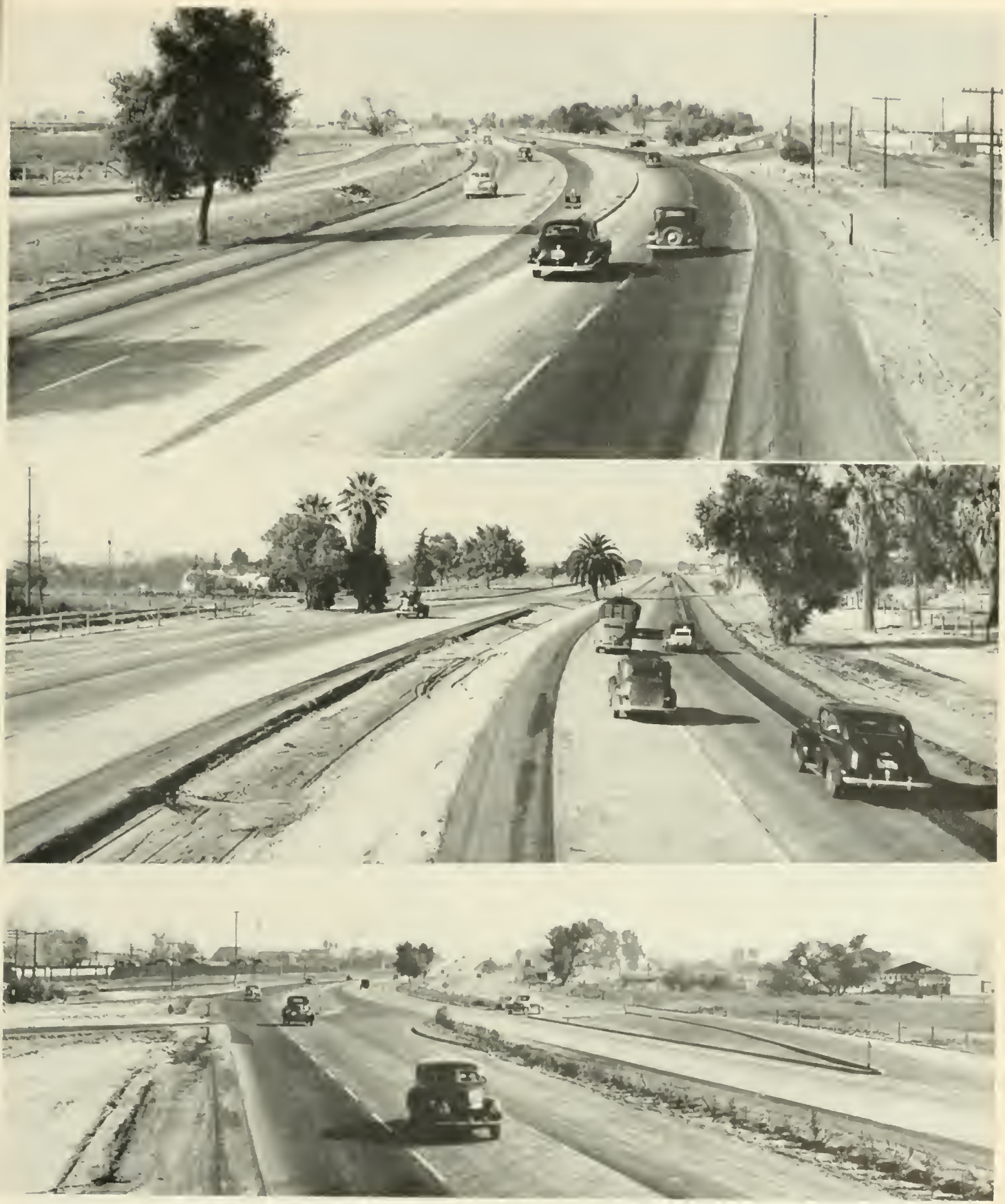
Approximately 2,000 linear feet of concrete-lined irrigation canal were relocated to eliminate the necessity for constructing two long siphons under the freeway.

The project will be completely landscaped in keeping with the semi-arid climate of this region. Rows of oleanders will be planted along each side of the right of way with a third row in the center dividing strip. Cork oak trees will be planted at 100-foot intervals in the outer rows of oleanders. At intersections and in curbed traffic islands, low growing myrtles will be used. The various shrubs and trees have been selected with consideration for their adaptability to the local climate as well as from the standpoint of maintenance and their usefulness as traffic barriers and headlight screens.

The work was contracted by Marshall S. Hanrahan at a bid price of approximately $338,000. S. T. Ball is Project Superintendent for the Contractor, and C. F. Oliphant is Resident Engineer for the State.

CHINA HAS HIGHWAY PROGRAM

Construction of 118,430 miles of new highways is the goal of the Chinese national government's new five-year roadbuilding program. Main roads will be under the control of the central government; secondary roads will be administered by the provinces.



Upper—Looking northerly towards Cedar Avenue intersection. Old highway on upper right. Center—Looking north. Palm tree in center at Orange Avenue intersection. Lower—Looking southerly. Channelization at Cedar Avenue intersection. Calwa Overpass in distance

Bayshore Freeway Construction

By W. G. REMINGTON, Associate Highway Engineer

THE Bayshore Freeway is, to many thousands of motorists entering and leaving San Francisco from and to the south, becoming a near reality with the letting of several road and structure contracts for work between San Mateo and South San Francisco.

Particularly noticeable to users of the present overcrowded Bayshore Highway is construction on a contract for 2.2 miles of freeway between Broadway in Burlingame and State Street in San Mateo which was awarded to the Guy F. Atkinson Company at a cost of approximately $630,000. This project utilizes the present traveled way for three lanes of a six-lane freeway with an outer highway and miscellaneous ramps and connections. Additional right of way to accommodate this project provides a minimum width of 153 feet expanding to greater widths as necessary at points of interchange and along tideland areas.

ACCESS RIGHTS ELIMINATED

All access rights from abutting properties have been eliminated from the freeway except at points where interchange structures provide this service.

The present four-lane Bayshore Highway was completed in 1931 and consists of a high standard Portland cement concrete surface 40 feet in width. This route is the main artery serving San Francisco from the south and accommodates a large percentage of the commuter traffic to and from the rapidly expanding residential area in San Mateo and Santa Clara Counties.

Traffic on this route has increased rapidly in the past 15 years until over 25,000 cars per day are now carried over the section included in this project. Hourly peaks of over 3,000 cars have recently been observed. A large percentage of the traffic is composed of heavy trucks and the accident rate on this section of the Bayshore Highway is one of the highest in the State. These conditions dictated that the present highway be reconstructed along full freeway standards with all direct access, left turns and crossing movements completely eliminated.

Looking north on Bayshore project, showing construction of fill for northbound freeway section. Traffic is on present traveled way



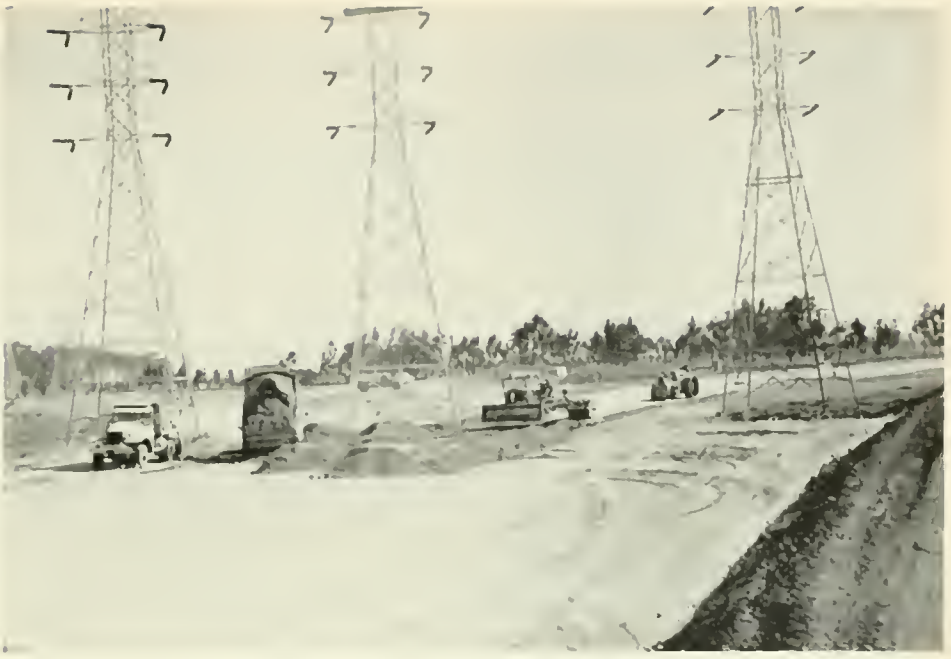
SIX-LANE FREEWAY

Development of the six-lane freeway section is being accomplished, first by utilizing the existing pavement for the southbound traffic. The present 40-foot traveled way will be reduced to 36 feet by placing a "Class C Fine" seal coat on the outer four feet of the existing pavement as well as on four feet of the existing shoulder on that side, thus providing three 12-foot lanes for traveled way and an eight-foot shoulder on the outside. The existing shoulder will be utilized on the inside for a width of eight feet.

Northbound freeway traffic will be routed over a new section being constructed on the east or bay side of the existing pavement. This new section will consist of a Portland cement concrete slab of a uniform eight-inch thickness placed on a half inch sand cushion over four inches of crusher run base. The outside shoulder will consist of two inches of plant mixed surfacing eight feet wide placed over a three-foot crusher run base border of variable depth adjacent to the pavement while the inside shoulder will be two feet wide and placed on crusher run base. Adjacent edges of the northbound and southbound traveled ways are 36 feet apart.

Design of the freeway section provides sufficient width for the construction of two additional lanes within the center division strip and still allows a minimum separation of 12 feet.

An outer highway is being provided on the west side of the freeway to serve the existing highway frontage and the numerous city streets which intersect the present Bayshore Highway. This outer highway will consist of a 23-foot, two-lane traveled way constructed of three inches of asphalt concrete placed on six inches of crusher run base. On the east or freeway side a Portland cement concrete curb and one-foot gutter are being constructed. On the right an eight-foot Portland cement concrete curbed parking strip six inches thick will be placed directly on select imported borrow. Provision for a sidewalk area with a nominal width of 10 feet between the face of the outside curb and the right of way line has been made.



Looking south, showing construction of freeway fill and fill for overhead around existing Pacific Gas and Electric power poles

The parkway between the freeway and outer highway will be a minimum of 11 feet from the edge of the freeway shoulder to the inside curb of the outer highway. A chain link fence along this parkway will provide a physical barrier.

An overhead grade separation at Peninsular Avenue is being constructed simultaneously with the road work under a contract awarded to the Macco Construction Company at a cost of approximately $282,000. T. E. Ferneau is Resident Engineer for the Bridge Department on the structure. Ramps and connection to this structure are being built under the road contract and will be surfaced with three inches of asphalt concrete placed on six inches of crusher run base.

At either end of the project transition sections are planned to taper into the existing roadway. Surfacing for the transition at the south end of the project will be four inches of alphalt concrete placed on eight inches of crusher run base. It is anticipated that this connection will be in service for several years.

The northerly transition will have three inches of plant mixed surfacing on eight inches of crusher run base.

Looking south showing construction of final subgrade



This latter connection will be more temporary and will be removed to connect the freeway with the 5.1 miles of freeway around the San Francisco Airport, now under construction under a contract recently awarded to the Macco Construction Company and Morrison-Knudsen Company, Inc., at a cost of approximately $2,900,000.

240,000 TONS OF MATERIAL

It has been necessary to use imported borrow to construct a majority of the fills and ramp connections due to the small amount of excavation and the lack of any other suitable material within the limits of the job. This item amounting to approximately 240,000 tons is, therefore, one of the major items of the contract.

A small area of marshy ground with a mud depth varying to a maximum of 12 feet was encountered at the beginning of the project under both the freeway and the outer highway and extending from Broadway for a distance of approximately 1,000 feet south. The lower two feet of the fills in this area, the heights of which average about six feet, has been made of imported borrow of a rocky nature that will not break or soften in the presence of water.

A surcharge has been placed on this fill by building it approximately one foot above the final pavement grade. Settlement measuring platforms were constructed in these fills and a record of the settlement has been made both during construction of the fill and after placement of the surcharge was complete. The surcharge will not be removed until settlement has either ceased or is satisfactorily stabilized.

The new freeway section is immediately adjacent and subject to action of the bay for a length of about 1,600 feet. A heavy riprap wall two and one-half feet thick and on a 1½:1 slope is provided on the bay side slope of the fill in this area.

There are no major structures on the project except for the overhead at Peninsular Avenue which was previously mentioned. Drainage is cared for in the main by extending and modifying existing facilities to the requirements of the new freeway. This includes extension of one triple 10′ x 8′ reinforced concrete box culvert, extension of numerous small pipe culverts and the construction of necessary inlets.

The initial stage of landscaping is provided for by scarifying and placing top soil on the center division strip, the parkway between the freeway and outer highway and the easterly slope of the freeway except in area where riprap wall is being placed. Western rye grass will be seeded in these areas.

This project should be completed and opened to public traffic early in the spring of 1947.



Looking north along riprap wall and adjacent fill

W. G. Remington is Resident Engineer in direct charge of the project which is under the general supervision of Jno. H. Skeggs, District Engineer, and R. P. Duffy, District Construction Engineer.

Old "Diggins" Scene of Road Work

(Continued from page 8)

separation structures will be completed early in 1947 and before the completion of the grading and paving contract.

The new road will be an integral portion of U. S. Route 40 and will carry interstate as well as local traffic. The estimated present average daily traffic is 7,000. The section of road now being constructed will replace the existing route of the highway through the streets of Auburn now inadequate to care for the increased traffic on U. S. Route 40 and the augmented local travel.

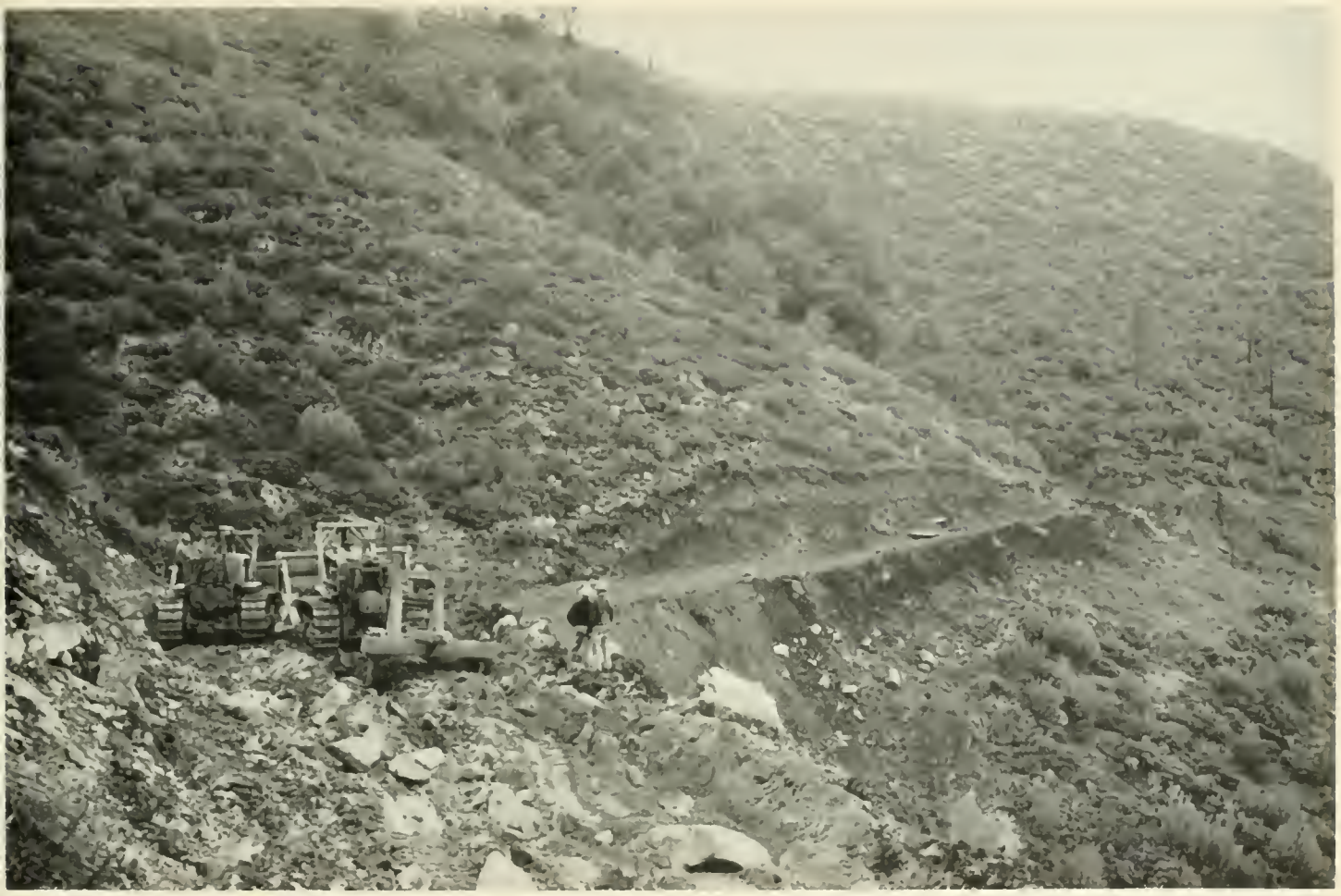
The work through Auburn required the relocation and adjustment of many sanitary sewer and water service lines, and such work is being done under the contract. It was also necessary to place 560 lineal feet of 48-inch reinforced concrete pipe to carry the Boardman Canal, a Pacific Gas and Electric Company facility, under the new roadway.

The major portion of the grading work has been completed. Heavy power scrapers were employed on most of this work, with a two-yard shovel excavating cuts on the easterly end of the project where rock was encountered. A large air compressor is employed in the drilling of the rock formations.

The Portland cement concrete paving will not be placed until next spring. Three inches of the four inches of imported subgrade material placed under the pavement will be bituminous treated. The subgrade material will be obtained from an abandoned railroad fill of disintegrated granite near Newcastle.

The connecting ramps to the separation structures at East, Walsh and Elm Streets will be constructed of crusher run base five inches thick with a wearing surface of three inches of plant-mixed material.

The contract for this work was awarded on June 24, 1946, to Fredrickson and Watson Construction Company. The total amount of the contract is $614,492.50. The same company was also awarded a contract September 16, 1946 in the amount of $194,103.12 for the construction of 1.7 miles of highway between Auburn and the Wise Canal on the Auburn-Grass Valley highway. A channelized connection will be made with the new construction on U. S. Route 40 in Auburn in the vicinity of the East Street separation structure. The Resident Engineer on both contracts is E. L. Miller, and the work is under the supervision of C. H. Whitmore, District Engineer.



Public Roads Administration engineers overcoming obstacles presented by rugged terrain

Mosquito Ridge Road Will Relieve Lumber Shortage

(Continued from page 29)

vert at Volcano Creek which handles waste from hydraulic mining operations and a 500-foot steel deck truss bridge across the North Fork of the Middle Fork of the American River.

Prior to designation of the road as a forest highway, Public Roads Administration was requested to prepare plans and supervise contract construction of the North Fork of the American River Bridge using forest development road funds furnished by the Forest Service. This construction is now under way with delivery of fabricated structural steel expected about mid-1947. Principal feature of interest on the bridge is the planned construction on a 260-foot radius curve. Total cost of the bridge is estimated at $215,000. Fred D. Kyle of Pasadena is the superstructure contractor and John B. Kiely is resident engineer for Public Roads Administration.

Forest highway funds have been programmed for grading and surfacing the entire route at an estimated total cost of about $1,500,000.

Contracts for two sections have been awarded and construction is under way. The initial seven-mile section from Forest Hill passes through numerous gold mining claims and old mine workings. Because of the possibility of grading operations uncovering veins or pockets of gold, right-of-way agreements provide in certain cases that construction operations be halted temporarily, if values are exposed, so that owners may remove the ore. The construction contract stipulates accordingly. Total cost of the seven-mile section is estimated at $500,000. W. C. Thompson, Inc., of San Francisco is the contractor and the public roads resident engineer is R. W. Schmidt.

A contract for an additional 4.8 miles from the North Fork Bridge easterly has been awarded recently to Leo G. Lynch of Danville. This portion, which requires construction of a temporary river crossing for access, is characterized by very steep side slopes. Since embankments cannot be constructed generally approximately 239,000 of the 320,000 cubic yards of excavation involved is "waste." Total estimated cost of this section is $400,000. J. E. Wood is resident engineer for Public Roads.

While the road is being developed primarily to make available additional commercial timber, it also will provide access to hunting, fishing, and other recreational areas in the High Sierra region west of Lake Tahoe, which in the past have been served only by a narrow, steep and dangerous road from Soda Springs on U. S. 40, and will aid in forest fire control and in general administration of the National Forest.



Johnson finishing machine at work on newly laid Portland cement concrete

STOCKTON-LODI FREEWAY WELL UNDER WAY

(Continued from page 7)

tiates the basis of heavy design for these two new pavement lanes.

In brief, the design calls for the removal of roadway excavation to a point two and one-half feet below the top of pavement grade, and 90 percent compaction of the excavated portions and the original ground for a minimum depth of six inches additional. Upon this compacted ground there is placed 18 inches of compacted imported subbase material, a four-inch thickness of cement treated base, and an eight-inch uniform thickness of five-sack Portland cement concrete pavement without expansion joints. The outside traffic lane is 11 feet in width and the passing lane 12 feet in width tied together with tie bolts to prevent spreading of the slabs. The shoulders are eight feet in width on the outside, consisting of three feet of untreated rock border six inches in thickness with an armor coat adjacent to the pavement edge, and a penetration oil treatment for the remaining width. The shoulder on the inside is five feet in width with a two foot width rock border of six inch thickness finished in a manner similar to the outside shoulder.

BRIDGE CONSTRUCTION

There are three bridge structures on this project 27 feet in width between curbs with a four-foot width sidewalk located on the outside. A bridge at Mosher Slough 82 feet in length has no skew, whereas a bridge 91 feet in length at Bear Creek and another 60 feet in length at Live Oak Slough are each constructed with a 45-degree angle skew. These bridges are tied directly to the existing bridge structures on the present pavement so as to provide a continuous channel under the divided highway. The present project includes the construction of a four-foot sidewalk on the outside of the existing structures also so as to provide a walk on each side of the freeway.

This project is located on almost straight alignment throughout. The former right of way was 100 feet in width with the existing two lanes located in the center of this right of way. The acquisition of rights of way therefore involved obtaining access rights on both sides, and the taking of a 60 foot strip on the easterly side, throughout, in order to provide a 36 foot width of center division strip between ultimate inside pavement edges and a symmetrical geometrical design. This involved acquisition for a total of 158 right of way cases, 155 of which were acquired through negotiation, and three of which were settled in court. Seventy of these cases involved the moving and relocation of improvements. On 48 of these the improvements were moved and rehabilitated by the owners under their individual right



Showing position of new lane in relation to the existing lane. Material between steel headers is cement treated base with curing seal applied

of way contracts with the State. These improvements consisted of eight residences, three service stations, one commercial garage, three stores, one cafe, and numerous smaller buildings such as private garages, storage sheds, auto cabins, miscellaneous fences, irrigation facilities, etc.

Twenty-two properties were involved wherein the State was responsible for the moving and relocation of improvements. This involved 18 residences, three service stations, one commercial garage, one store, one cafe, and some 17 other miscellaneous buildings. Five contracts were awarded for this work upon a competitive bid basis, three going to Fred Kans of Stockton, one to Louis Biasotti & Son of Stockton and one to J. E. Fitzsimmons of Lodi. Most excellent cooperation by the property owners, the moving contractors and the general contractor on the highway project assisted greatly in getting this important project under way.

The main contract involves some 44,000 cubic yards of roadway excavation, — 200,000 square yards of ground compaction, –111,000 cubic yards of imported borrow and 124,000 cubic yards of imported subgrade material. It calls for 100,000 square yards of cement treated base which requires some 3,300 barrels of Portland cement. The pavement involves 24,000 cubic yards of concrete, and there are approximately 2,000 cubic yards of concrete and 270,000 pounds of reinforced steel in the structures cited above. The general contractor on this project is Frederickson and Watson Construction Company of Oakland whose contract work with the State is estimated to total $830,000.

The five building removal contracts approximate $100,000 and the building removal work by owners was about $82,000 included in a total estimated right of way cost of $361,000. Although final costs will not be exactly known until this contract is completed it is estimated that the right of way, construction and construction engineering involved for this 8.2 mile section will approximate $1,275,000. The present project under present progress should be completed in the spring of 1947. A. M. Lund is Resident Engineer.

Stockton, which is located in the heart of the San Joaquin Valley, one of the most fertile in the world, has been designated as one of the metropolitan areas of the State. Nearby Lodi is the home of the Tokay grape and is located in one of the most intensive grape and wine producing sections of the world. This highway, although not full freeway design, traversing a rich agricultural area and considered as a rural section, is indicative of the cost of providing limited access freeways.

This project will connect directly to another postwar project extending southerly through the Stockton metropolitan area on a revised location which contemplates many full freeway characteristics. Rights of way have been acquired upon this other project and the start of its construction is contemplated for the year 1947. Upon completion of these two projects some of the most troublesome traffic problems of U. S. 99 and U. S. 50 in the Stockton metropolitan area will be solved.

Highway Bids and Contract Awards for October and November, 1946

October, 1946

CONTRA COSTA COUNTY—Between Fourth St. and First St. in Rodeo, about 0.3 mile, to be widened and paved with asphalt concrete on crusher run base. District IV, Route 14, Section B, J. R. Armstrong, El Cerrito, $17,156. Contract awarded to Lee J. Emmel, San Pablo, $17,150.

FRESNO COUNTY—Between one-quarter mile south of Fowler and Calwa overpass, about 6.5 miles, to be graded and paved with plant-mixed surfacing on cement treated base. District VI, Route 4, Section A, Fow.,B. Basich Bros. Construction Co. & Basich Bros., Alhambra, $836,755; Peter Kiewit Sons' Co., Arcadia, $896,229. Contract awarded to Gunner Corp. & J. E. Haddock, Ltd., Pasadena, $778,949.

HUMBOLDT COUNTY—Between Arcata and Ryans Slough Bridge, about 8 miles, a graded roadbed to be constructed, and plant-mixed surfacing to be placed on imported base material and on existing surfacing. District I, Route 501, W. C. Railing, Redwood City, $215,592. Contract awarded to Mercer-Fraser Co., Eureka, $185,557.

HUMBOLDT COUNTY—At Dyerville, pile and heavy stone riprap bank protection to be constructed. District I, Route 1, Section D, Evans Construction Co. and Barton & Anderson, Berkeley, $48,660. Contract awarded to Mercer-Fraser Co., Eureka, $39,392.

HUMBOLDT COUNTY—Between Redwood Summit and one mile east of Redwood Creek, portions, a net distance of about 4.7 miles, imported base material to be furnished and placed. District I, Route 20, Sections B,C. Mercer-Fraser Co., Eureka, $71,052; Johnson, Drake & Piper, Inc., Oakland, $90,450. Contract awarded to W. C. Railing, Redwood City, $59,744.

IMPERIAL COUNTY—About 9 miles and 15.5 miles northwest of Westmorland, at Lone Tree Wash and San Felipe Creek, two bridges and approaches thereto to be constructed. District XI, Route 26, Sections B,C. United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $284,066. Contract awarded to Bent Construction Co., Los Angeles, $245,709.

KERN COUNTY—At Bakersfield between Brundage Lane and 21st Street, traffic signals and illuminating devices to be furnished and installed. District VI, Route 4, Section C, Bkd. Econolite Corp., Los Angeles, $39,100. Contract awarded to Oilfield Electric Co., Ventura, $37,562.

KERN COUNTY—Between Cawelo and Famoso Underpass, about 6.7 miles to be graded and paved with Portland cement concrete, plant-mixed surfacing to be placed on the shoulders and a reinforced concrete bridge to be constructed across Poso Creek Overflow. District VI, Route 4, Section E, N. M. Ball Sons, Los Angeles, $527,012; J. E. Haddock, Ltd., Pasadena, $595,860; Bowen & McLaughlin & L. G. Lynch, Danville, $627,068; M. J. B. Construction Co., Stockton, $636,634. Contract awarded to Griffith Co., Los Angeles, $515,503.

KERN COUNTY—Between Route 4 and five miles north, about 5.1 miles to be graded and surfaced with road-mixed surfacing on imported borrow and on crusher run base. District VI, Route 129, Section A, Rand Construction Co., Bakersfield, $188,898; M. J. Ruddy & Son, Modesto, $196,486; Griffith Co., Los Angeles, $198,345; Rexroth & Rexroth, Bakersfield, $206,684; Vinnel Co., Alhambra, $212,038; George von KleinSmid, Bakersfield, $214,913; W. C. Railing, Redwood City, $218,501; Brown-Doko, Pismo Beach, $252,619. Contract awarded to George E. France, Visalia, $166,504.

LOS ANGELES COUNTY—In the City of Los Angeles, adjacent to Hollywood Parkway, between Diamond Street and Sunset Boulevard, storm drains and sanitary sewer construction appurtenant to four level grade separation structure to be constructed. District VII, Route 2, Section L.A. Mike Radich & Co., Burbank, $228,102; Artukovich Bros., Hynes, $324,089; J. E. Haddock Ltd., Pasadena, $389,307. Contract awarded to Chas. T. Brown Co., San Fernando, $182,543.

LOS ANGELES COUNTY—Between Route 77 and Pomona, about 0.7 mile to be graded and widened with Portland cement concrete, and existing pavement to be surfaced with plant-mixed surfacing on a portion. District VII, Route 19, Section B,Pom. Cox Bros. Construction Co., Stanton, $71,169; United Concrete Pipe Corp., Baldwin Park, $88,237. Contract awarded to Matich Bros., Colton, $70,325.

LOS ANGELES COUNTY—Between Latigo Canyon and Malibu Creek, about 4.5 miles to be graded and paved with Portland cement concrete. District VII, Route 60, Section A, H. Earl Parker & N. M. Ball Sons, Los Angeles, $1,561,101; Guy F. Atkinson Co., Long Beach, $1,591,308; Bressi & Bevanda Constructors, Los Angeles, $1,627,667; Bowen & McLaughlin & L. G. Lynch, Danville, $1,808,201; United Concrete Pipe Corp., Ralph A. Bell, Vinnell Co., Baldwin Park, $1,859,533; Matich Bros. & L. A. & R. S. Crow, Colton, $1,893,329. Contract awarded to Peter Kiewit Sons Co., Arcadia, $1,543,233.

LOS ANGELES COUNTY—Between Sproul Street and Anaheim-Telegraph Road, about 1.5 miles, to be resurfaced with plant-mixed surfacing and bituminous surface treatment to be applied to shoulders. District VII, Route 170, Section A, Cox Bros. Construction Co., Stanton, $23,205. Contract awarded to Griffith Co., Los Angeles, $22,372.

MENDOCINO COUNTY—Between Northwestern Pacific R.R. grade crossing and Northwestern Pacific R.R. underpass, about 0.8 mile, to be graded and surfaced with cement treated base and plant-mixed surfacing. District 1, Route 1, Section E, Louis Biasotti & Son, Stockton, $170,027; N. M. Ball Sons, Berkeley, $171,376; Guy F. Atkinson Co., South San Francisco, $189,441. Contract awarded to A. R. McEwen & C. M. Syar, Willits, $136,870.

MENDOCINO COUNTY—Between Red Mountain Creek and Piercy, about 4.6 miles, to be graded and paved with plant-mixed surfacing on cement treated base. District 1, Route 1, Section K, Parish Bros., Benicia, $748,549; A. Teichert & Son, Inc., Sacramento, $796,040; H. Earl Parker & Clements & Co., Marysville, $824,581; N. M. Ball Sons, Berkeley, $841,107; Guy F. Atkinson Co., South San Francisco, $932,660; Piombo Construction Co., San Francisco, $981,915; Chas. L. Harney, San Francisco, $1,159,583. Contract awarded to Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, $718,234.

MENDOCINO COUNTY—Between Bromley Creek and Fort Bragg, about 3.8 miles to be graded, surfaced with plant-mixed surfacing on imported base material; and structures to be constructed at Mitchell Creek and Hare Creek and foundations at Noyo River. District 1, Route 56, Section E, United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $1,568,257; Stolte Inc. & E. B. Bishop, Oakland, $1,673,445; J. H. Pomeroy & Co. Inc., San Francisco, $1,769,698; Haddock Engineers, Ltd., Oceanside, $1,909,521. Amended contract awarded to Guy F. Atkinson Co., South San Francisco, $874,215.

MONTEREY AND SAN BENITO COUNTIES—Between 0.8 mile north of Crazy Horse Summit and Chittenden Road, about 6.7 miles to be graded, crusher run base and plant-mixed surfacing to be placed and seal coat to be applied. District V, Route 2, Sections J,B. H. Earl Parker & N. M. Ball Sons, Berkeley, $877,428; E. W. Elliott Construction Co., San Francisco, $880,971; Fredrickson & Watson Construction Co., Oakland, $941,899; Parish Bros., Benicia, $983,830. Contract awarded to A. Teichert & Son, Inc., Sacramento, $723,658.

SACRAMENTO COUNTY—Across Bear Slough, 4.5 miles west of Galt, a reinforced concrete slab bridge to be constructed. District III, Route 900, Republic Construction Co., Lodi, $82,347; Dan Caputo, San Jose, $85,660; Bent Construction Co., Los Angeles, $100,291; Johnson Western Co., Alameda, $117,515. Contract awarded to M. A. Jenkins, Sacramento, $74,295.

SACRAMENTO COUNTY—Across Laguna Creek, about 0.8 mile north of Elk Grove, a reinforced concrete slab bridge to be constructed. District III, Route 933, Lew Jones Construction Co., San Jose, $36,394; Wm. E. Thomas, Sacramento, $37,714; A. Teichert & Son, Inc., Sacramento, $43,442; A. L. Miller, Sacramento, $46,331; S. C. Giles and Co., Stockton, $46,704; Republic Construction Co., Lodi, $48,537; Dan Caputo & Ed Keeble, San Jose, $50,991; Wheeler Construction Co., Oakland, $53,085. Contract awarded to Bati Rocca, Stockton, $34,074.

SAN BERNARDINO COUNTY—Between 8.6 miles and 11.7 miles north of San Bernardino, about 0.4 mile, to be widened and surfaced with plant-mixed surfacing. District VIII, Route 43, Section A, Cox Bros. Construction Co., Stanton, $63,384. Contract awarded to Geo. Herz & Co., San Bernardino, $39,323.

SAN FRANCISCO COUNTY—In the City of San Francisco, the existing steel bridge over Presidio of San Francisco to be cleaned and painted. District IV, Route 2, D. E. Burgess Co., San Francisco, $36,600; Pacific Bridge Painting Co., San Francisco, $51,278. Contract awarded to R. W. Reade & Co., Berkeley, $33,174.

SAN JOAQUIN COUNTY—Painting portion of steel bridge over Mokelumne River about one mile north of Clements. District X, Route 97, Section B, D. E. Burgess Co., San Francisco, $1,175; F. Kaus, Stockton, $1,975; R. W. Reade & Co., Berkeley, $868; James B. Haynie, Stockton, $1,185. Contract awarded to Fred T. Judd Co., Berkeley, $692.

SAN MATEO COUNTY—Bay Shore Freeway from Colma Creek in South San Francisco to Broadway Ave. in Burlingame, about 5.1 miles to be graded and paved with asphalt concrete on crusher run base. District IV, Route 68, Sections S,Sf.,F, Burl. Guy F. Atkinson Co., South San Francisco, $3,365,440; Chas. L. Harney, San Francisco, $4,128,363; Eaton & Smith, San Francisco, $4,656,694. Contract awarded to Macco Corp. & Morrison-Knudsen Co. Inc., San Bruno, $2,993,138.

SANTA BARBARA COUNTY—Between ¼ mile east of Las Varas Creek and ¼ mile east of El Capitan Creek, about 2.9 miles to be graded and surfaced with plant-mixed surfacing on imported borrow. District V, Route 2, Section G, Winston Bros. Company, Los Angeles, $486,189; J. E. Haddock, Ltd., Pasadena, $493,931; Basich Brothers Construction Co. & Basich Bros., Alhambra, $502,544; Dimmitt & Taylor, Los Angeles, $547,720; Ralph A. Bell & A. F. Heinze, Monrovia, $555,764; E. W. Elliott Construction Co., San Francisco, $599,835. Contract awarded to N. M. Ball Sons, Los Angeles, $418,948.

SANTA BARBARA COUNTY—At Santa Barbara between Ashley Street and De La Vina Street, buildings to be demolished. Dis-

rict V, Route 2, Joseph D. Ballinger & Co., Oakland, $4,175; Santa Barbara Crane Service, Santa Barbara, $1,512; Emsco Concrete Cutting Co., Los Angeles, $6,284; Brown & Doko, Pismo Beach, $8,550; Cleveland Wrecking Co. of Cincinnati, Los Angeles, $7,900. Contract awarded to Mead House Wrecking Co., Pasadena, $3,385.

November, 1946

FRESNO COUNTY — Between Shields Avenue and Herndon Avenue, about four miles to be graded and paved with asphalt concrete on crusher run base. District VI, Route 125, Section C. J. E. Haddock, Ltd., Pasadena, $323,923; Granite Construction Co., Watsonville, $336,999; Frederickson & Watson Construction Co., Oakland, $343,455; N. M. Ball Sons, Berkeley, $344,106; Griffith Company, Los Angeles, $345,380; Piazza & Huntley, San Jose, $359,928; M. J. B. Construction Co., Stockton, $359,113. Contract awarded to Basich Brothers Construction Co. & Basich Bros., Alhambra, $316,444.

FRESNO COUNTY—On Fresno-Coalinga Road, between Mt. Whitney Avenue and State Highway Route 10, about 8.6 miles to be graded, surfaced, with imported surfacing material and bituminous surface treatment applied. District VI, Route 809. John M. Perry, Glendale, $164,404; Ted F. Baun, Fresno, $165,730; S. Edmondson & Sons, Los Angeles, $188,120; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, $196,-72; Volpa Brothers, Fresno, $203,707; Griffith Company, Los Angeles, $212,400; J. E. Haddock, Ltd., Pasadena, $213,033; W. C. Bailing, Redwood City, $211,813; N. M. Ball Sons, Berkeley, $217,500; Clyde W. Wood, Inc., North Hollywood, $218,835; Brown-Doko, Pismo Beach, $248,420; Owl Trucking & Construction Co., Compton, $245,634. Contract awarded to Louis Biasotti & Son, Stockton, $156,420.

LOS ANGELES COUNTY — Hollywood Parkway, at Silver Lake Boulevard in the City of Los Angeles, a reinforced concrete undercrossing to be constructed. District VII, Route 2. E. B. Bishop, Orland, $492,319; J. E. Haddock Co., Pasadena, $523,104; Oberg Bros., Inglewood, $523,898; E. W. Elliott Construction Co., San Francisco, $529,738; Winston Bros. Co., Los Angeles, $547,394; United Concrete Pipe Corp., Baldwin Park, $547,912; Johnson Western Co., San Pedro, $561,586; Contracting Engineers Co., Los Angeles, $571,776. Contract awarded to Guy F. Atkinson Co., Long Beach, $411,766.

LOS ANGELES COUNTY—At 16 intersections on Valley Boulevard between Westminster Avenue and Del Mar Avenue in the cities of Alhambra and San Gabriel, traffic signal systems to be furnished and installed. District VII, Route 77. Ecomolite Corp., Los Angeles, $56,840. Contract awarded to C. D. Draucker Co., Los Angeles, $55,504.

RIVERSIDE COUNTY—Across Coachella Canal, 5 miles east of Indio, a reinforced concrete slab bridge to be constructed. District VI, Route 61, Section H. E. H. Thomas Co., Los Angeles, $38,334; O'Brien & Bell Construction Co., Santa Ana, $39,868; Bent Construction Co., Los Angeles, $46,132; Cox Bros. Construction Co., Stanton, $59,839. Contract awarded to F. Fredenburg, Temple City, $35,544.

SAN DIEGO COUNTY — Across Santa Isabel Creek, about 8.7 miles east of Escondido, a bridge to be constructed, a cattle pass to be extended, and about 0.3 mile of approaches to be graded and bituminous surface treatment applied. District XI, Route 97, Sections A, B. United Concrete Pipe Corp., Baldwin Park, $219,282; N. M. Ball Sons, Los Angeles, $220,953; Carroll & Foster, San Diego, $234,411; Walter H. Barber, La Mesa, $238,974; Johnson Western Co., San Pedro, $248,899. Contract awarded to Spencer Webb, Inglewood, $218,957.

Federal Secondary Roads

By H. B. La FORGE, Engineer, Federal Secondary Roads

IN THE July-August, 1945, issue of this publication there appeared an article outlining the Federal-aid Secondary Program as it applied to California. This article is intended to summarize its status for those interested in the development of the program.

The "Federal-aid Highway Act of 1944" required the State in cooperation with the counties and the Public Roads Administration to select an initial system of principal roads which were not on the Federal-aid System but which were intergrated with that system. All details in connection with that selection were completed in February, 1946. As of November 1, 1946, Commissioner of Public Roads has approved an initial Federal-aid Secondary System consisting of 8,882 miles of which 5,184 miles are county roads and 3,698 miles are state highways.

The "County Highway Aid Act of 1945" stipulated that 87½ percent of the federal-aid secondary funds apportioned to the State should be expended on the county road portion of the Federal-aid Secondary System. In August of 1945 the counties were requested to select construction programs.

San Francisco City and County has no FAS routes. All other counties have submitted construction programs having a total estimated cost of $20,537,000. The proposed projects are distributed in the three following categories:

1. **Ninety-one road projects, length 620 miles, cost $11,650,000.**
2. **Sixty-four bridge projects, cost $6,002,000.**
3. **Twenty-four road and bridge projects, length 76 miles, cost $2,885,000.**

At this time 13 contracts have been awarded having a total estimated cost of $2,989,000. The work under way includes nine road and four bridge contracts. The following contracts are under way:

Alameda, FAS route 1030, San Lorenzo Creek to Proctor Road, length 2.7 miles, cost $170,000.

Fresno County, FAS Route 809, about five miles Northeast of Oil King School on Fresno-Coalinga Road, length 8.6 miles, cost $171,000.

Humboldt, FAS Route 505, Ryan's Slough to Arcata, length 8.0 miles, cost $215,000.

Modoc, FAS Route 513, Eagleville to four miles north of Lake City, length 29.5 miles, cost $452,000.

Plumas, FAS Route 523, Big Meadows Dam to Lassen County line, length 9.9 miles, cost $405,000; bridge across Hamilton Branch of Feather River, cost $79,000.

Sacramento, FAS Route 900, bridge across Bear Slough four miles west of Galt, cost $82,000.

Sacramento, FAS Route 933, bridge across Laguna Creek about 0.8 miles north of Elk Grove, cost $34,000.

San Mateo, FAS Route 1052, Redwood City to Canada Road, length 2.9 miles, cost $220,000.

Santa Clara, FAS Route 992, Gilroy to State highway 32, length 4.5 miles, cost $187,000.

Siskiyou, FAS Route 753, Cal-Ore to four miles west of Hatfield, length 15.6 miles, cost $577,000.

Shasta, FAS Route 1072, Anderson to Cottonwood, length 10.8 miles, cost $257,000.

Sonoma, FAS Route 786, bridge across Russian River at Hacinda, cost $140,000.

Alameda, San Mateo, Humboldt, Sonoma and Fresno Counties are supplying their own resident engineers. State resident engineers are assigned to the above contracts in the other counties. It is the policy of the Division of Highways to encourage the counties to provide construction engineering personnel.

In addition to the above 13 contracts bids are being invited for three projects at an estimated cost of $500,000.

It is anticipated that about 19 contracts totaling $4,000,000 will be awarded this calendar year.

In addition to contracts under way or advertised, the counties have submitted plans, specifications and estimates for projects having a total estimated cost of approximately $3,000,000. It is expected that contracts for most of these projects will be awarded during 1947.

(Continued on page 44)

State Route 77 Is Being Modernized Between San Diego and Riverside

(Continued from page 18)

at a cost of about $4,000,000 on freeway standards. The portion within beautiful Balboa Park is being planted and improved as a parkway.

As long ago as March, 1941, the people of San Diego voted eight to one to set aside a 200-foot width of right of way through Balboa Park for highway purposes. With this fine start, plans were rapidly taking shape when the beginning of the war put a temporary stop to this work. From 1942 to 1944 the project was at various times considered as a possible access road, connecting military establishments in the vicinity of San Diego, but was finally set aside for other access roads which were considered more urgent. In 1944 the freeway was included as Postwar Project No. 116 in the State's postwar program of construction. Plans were completed in 1945 and at the close of the war preparations were made for advertising various units of this freeway at an early date. All units of the freeway except the landscaping are now being built under ten separate contracts through the cooperation of five different contractors.

TWO ROADWORK CONTRACTS

The roadwork, costing about $2,700,000 is divided into two contracts which include all grading, paving and drainage structures. The southerly three miles which follows the Eleventh Avenue Canyon through Balboa Park for almost two miles, will be extensively planted to provide a suitable blending with Balboa Park.

The northerly four miles of the freeway includes the grading and paving of approach ramps for a traffic interchange at Mission Valley Road, and is based on the latest modern design in grade separation structures. By means of two bridges carrying Mission Valley Road over the freeway, and direct on and off turning ramps, traffic can proceed with a minimum of delay and interference. This type of separation structure greatly reduces the distance traveled by left turn traffic as compared to the standard cloverleaf design.



Grading operations on Mitty Bros. Freeway contract just north of University Avenue—Grading operations on Basich Bros. contract, first big cut north of San Diego River—Looking north toward Washington Street Bridge—Looking west from Pascoe Street ramp toward Freeway.

SEPARATION STRUCTURES

Grade separation structures and ridges are provided at 11 locations, in addition to two bridges previously constructed by the State for the City of San Diego on Streets of Major Importance. The following streets and roads are to be taken under or over the freeway: Date Street, Quince Street, Upas Street, Richmond Street, University Avenue, Pascoe Street, Sixth Street Extension, Mission Valley Road (two structures), San Diego River and Friar's Road.

The typical section on the freeway consists of two 24-foot x 8-inch Portland cement concrete pavements laid on 12 inches of selected material or imported borrow, of which the top four-inch or six-inch layer has been cement treated. The concrete pavements are separated by an island, varying in width from six feet to fifty-four feet. Bituminous surface treated shoulders eight feet wide are provided throughout.

BALBOA PARK PROJECT

Through Balboa Park, a complete sprinkler system using more than 24,000 feet of pipe was provided to aid in the landscaping and roadside treatment which was designed to help blend the roadway with the natural park surroundings.

As most of the freeway follows natural drainage courses, a storm drain system with pipes ranging in size from 24 inches to 60 inches in diameter was provided throughout portions of the project.

Over 1,650,000 cubic yards of dirt with cuts as deep as 150 feet and fills as high as 60 feet, and more than 30,000,000 station yards of overhaul are involved in this seven miles of roadway. One cut contains approximately 300,000 cubic yards in less than one-fourth mile of length. Heavy road-building equipment up to thirty cubic yard capacity is being utilized to move this tremendous yardage.

NORTH-SOUTH ARTERY

The completed freeway will provide San Diego with an adequate north-south artery connecting the business district with the residential sections in the north and east parts of the city and Linda Vista Housing Project. Connecting ramps are provided at the more important separation structures. A braided intersection is developed at Washington Street, which connects with an extension of Washington Street to U.S. 80 (El Cajon Blvd.) to the east. A project for improvement of this portion of Washington Street is scheduled for construction in 1947 from funds for city streets of major importance.

The traffic interchange at Mission Valley Road provides a connection to one of San Diego's most important east-west by-passes. The section of Mission Valley Road west of the freeway connecting to U.S. 101 (Pacific Highway) and the beaches was recently built to high standards as a military access road. The section of Mission Valley Road to the east connects by way of Fairmount Avenue or Alvarado Canyon to U.S. 80 and the communities of La Mesa and El Cajon. This section is badly in need of improvement and is planned for reconstruction by the City and County authorities at an early date.

FUTURE CONSTRUCTION

Extension of the relocation northerly from the freeway to connect with the prison labor work from Escondido to the Riverside County line is planned as future construction. The 12 miles between Miramar and Lake Hodges is planned as Postwar Project No. 117, but is being delayed pending decisions as to the disposition of the Navy's Camp Miramar, and the proposed raising of Lake Hodges.

When all this construction is completed, the modernized Route 77 will be about 17 miles shorter than the old road. Literally hundreds of sharp curves will have been eliminated and a wider roadbed with greater safety and less delay to traffic will be the result.

Work is under the general direction of E. E. Wallace, District Engineer, District XI; Ed Rawson is Superintendent of the prison labor work; J. Frank Jorgensen and Howard F. Caton are Resident Engineers on the Freeway roadwork; H. R. Hineman and H. R. Lendecke are representing the Bridge Department as Resident Engineers on the freeway structures.

All Maintenance Men Are Very Much Alike

DISTRICT COURT OF APPEAL
Third District
Sacramento, California

Paul Peek
Associate Justice

Charles H. Purcell,
Director of Public Works,
Public Works Building,
Sacramento, California.

Dear Charlie: This is in the nature of a fan letter relative to an employee of your department, Mr. Lee Harvey, who works out of the Sonora Junction Maintenance Station.

Approximately a month ago, while Mrs. Peek's mother and a guest were on their way home to Pasadena after vacationing at Lake Tahoe, her automobile stalled due to serious mechanical trouble near where Mr. Harvey lives at the maintenance station. He very graciously helped them by placing flares about their car, saw to the arrangements for having it towed to a garage in Bridgeport, and then took them to his home where his wife prepared a wonderful trout dinner which they are still talking about.

Of course I do not advocate that every person stalled on the highway should be succored by a member of your department and treated in a comparable fashion, but certainly such thoughtfulness on the part of state employees goes a long way in establishing the good will of the people toward their public servants.

With kindest regards,
Sincerely,
(Signed) Paul Peek

California's Highway Builders

(Continued from page 2)

developing law relating to the acquisition of access rights will be fully discussed at the Los Angeles meeting.

By T. H. DENNIS
Maintenance Engineer

MAINTENANCE engineers, during the past several years, have been conducting intensive studies on methods to be employed in prolonging the service life and efficiency of various highway facilities. Hand in hand with these investigations are those involving the efficient use of men and equipment. It is expected that the results of these studies will be elaborated upon in the committee meetings which are to be held during the convention.

The exchange of ideas and personal experiences at these meetings goes far beyond the information which could be presented in a general report on these subjects. In these days of rising costs and heavy traffic, it is felt that we in California will be particularly benefited in this personal contact with the acknowledged experts who will be present at this meeting.

By A. M. NASH
Surveys and Plans

THE REAL purpose and justification for such conventions is of special significance to the particular Department of the California Division of Highways over which I preside.

We are charged with the review and approval of all designs and I believe I am safe in saying that no aspect of highway engineering has seen such great changes take place in methods of procedure or in basic concepts of approach as this phase of our profession during the last few years as we embark upon a great program of expressway design. Many of these changes are still in a state of flux as we strive to analyze and isolate the laws of traffic behavior and translate this knowledge into rules of design to the end that better and safer highways will be the result of our efforts.

Because of this fact, it is particularly important that all of the individuals who are striving toward this goal meet together as often as possible to mutually consult and evaluate their experiences and ideas as they strive to separate the true from the false.

In the open committee forums of the convention, free and honest debate and deliberation have always acted to stimulate the thinking of all the participants and have served the cause of scientific knowledge well.

There is every reason to hope that our Los Angeles meeting will be particularly fruitful in this regard, and it is with keen anticipation that I look forward to meeting with my colleagues so that I may learn both from their successes as well as their failures and thus improve my knowledge and understanding to the important end that better designed highways will result here in California.

By F. W. PANHORST
Bridge Engineer

THE Los Angeles Convention will have two full-day meetings packed with important subjects and projects. On Monday, December 16th, there will be an all day preconvention meeting to discuss proposed changes in the Specifications for Highway Bridges, which meeting is open to members and associates only. On Wednesday, December 18th, the regular group meeting, open to all, will be held at 9:30 a.m., at which time Prof. J. S. Worley, of the University of Michigan, will speak about "Design Loads for the Interstate Highway System." At this time there also will be a discussion of clearance required for navigation at bridges over navigable streams.

In the afternoon, R. Robinson Rowe, of the California Bridge Department, will speak on "Culvert Design." There also will be a discussion of requirements for protection of highway traffic on bridges with movable spans. Our bridge specifications are used by all of the states and many foreign countries. They are not perfect and much is yet to be done. With the large amount of bridge work ahead of us, it is important that necessary changes be made in the specifications.

This meeting of A. A. S. H. O. is called a convention and there will be many interesting trips and breathtaking entertainment features, but of much more significance is the fact that there is important business to be transacted.

Federal Secondary Roads

(Continued from page 41)

All of the projects under contract or for which plans have been received represent forthcoming improvements vital to the economic needs of the respective counties. When completed traffic upon these roads will be relatively high both as to volume and weight and the standards of construction have been selected accordingly. Because of their nature and location the projects will benefit very large county areas and will prove prideful improvements to the county road system.

Increasing progress in plan preparation is reported by county engineers and it is hoped that during 1947 the program will be in full swing with about $10,000,000 of additional projects placed under construction.

Burnt Ranch, Calif.
November 5, 1946

Mr. G. F. Hellesoe, Acting
District Manager
Division of Highways
546 W. Wabash Avenue
Eureka, California

Dear Mr. Hellesoe: On September 2d, I wrote the State Highway Commission at Sacramento in re the dangerous condition of the point on U. S. Highway 299 where our county road intersects said highway. I wrote this letter as unofficial spokesman for our various neighbors here who were affected by this dangerous intersection.

Now, on behalf of myself and my neighbors I wish to thank you for the promptness and efficiency with which you handled our plea for a correction of the condition complained of.

Your workmen have placed our road in such condition that there would be no possible excuse for an accident at that particular point now. We feel that the hazard has been entirely removed and everyone seems well pleased with the result of your efforts in our behalf.

Respectfully,
(Mrs.) Ellarena M. Stetter

State of California

EARL WARREN, Governor

Department of Public Works

Headquarters Public Works Building, Twelfth and N Streets, Sacramento

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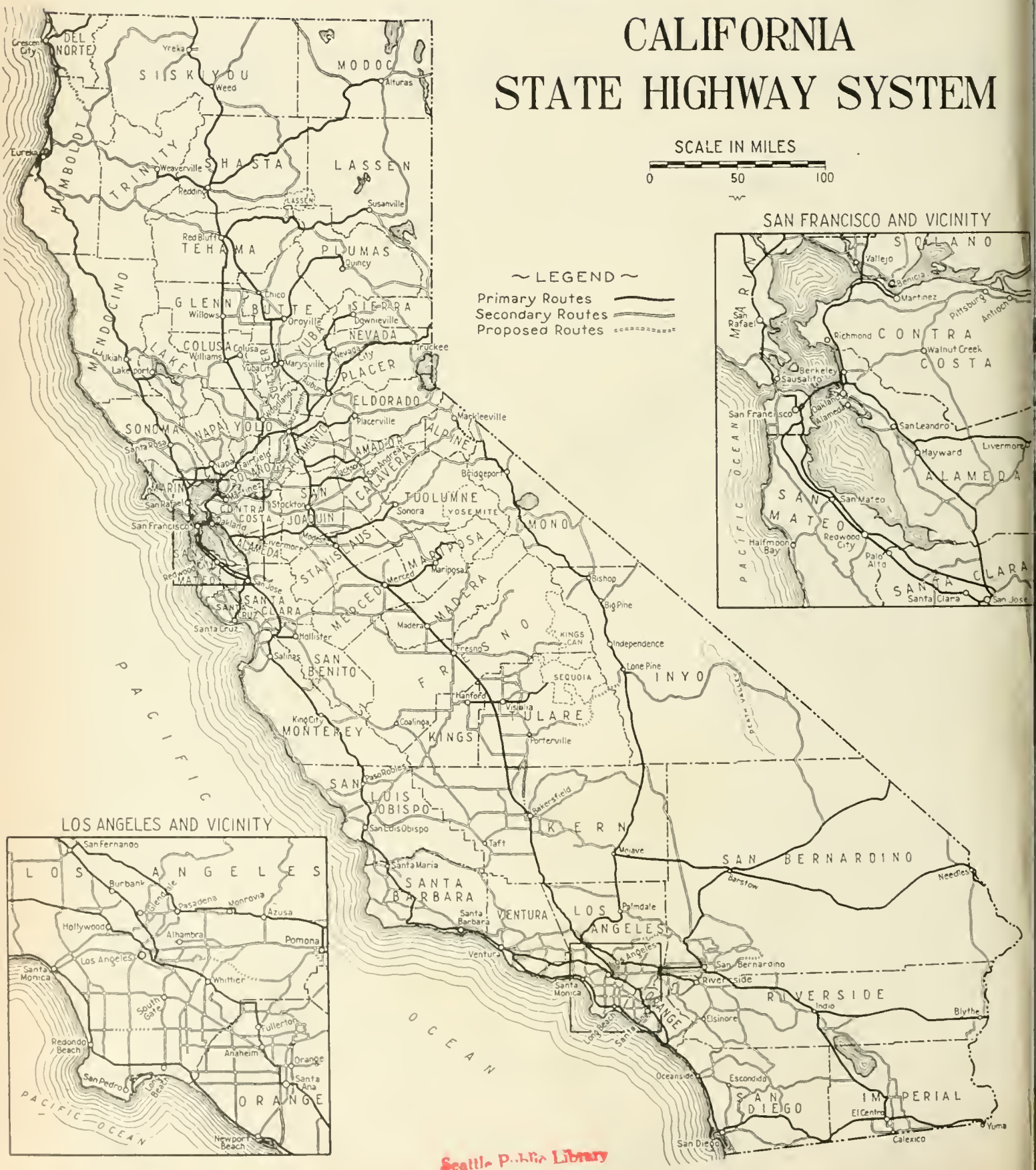
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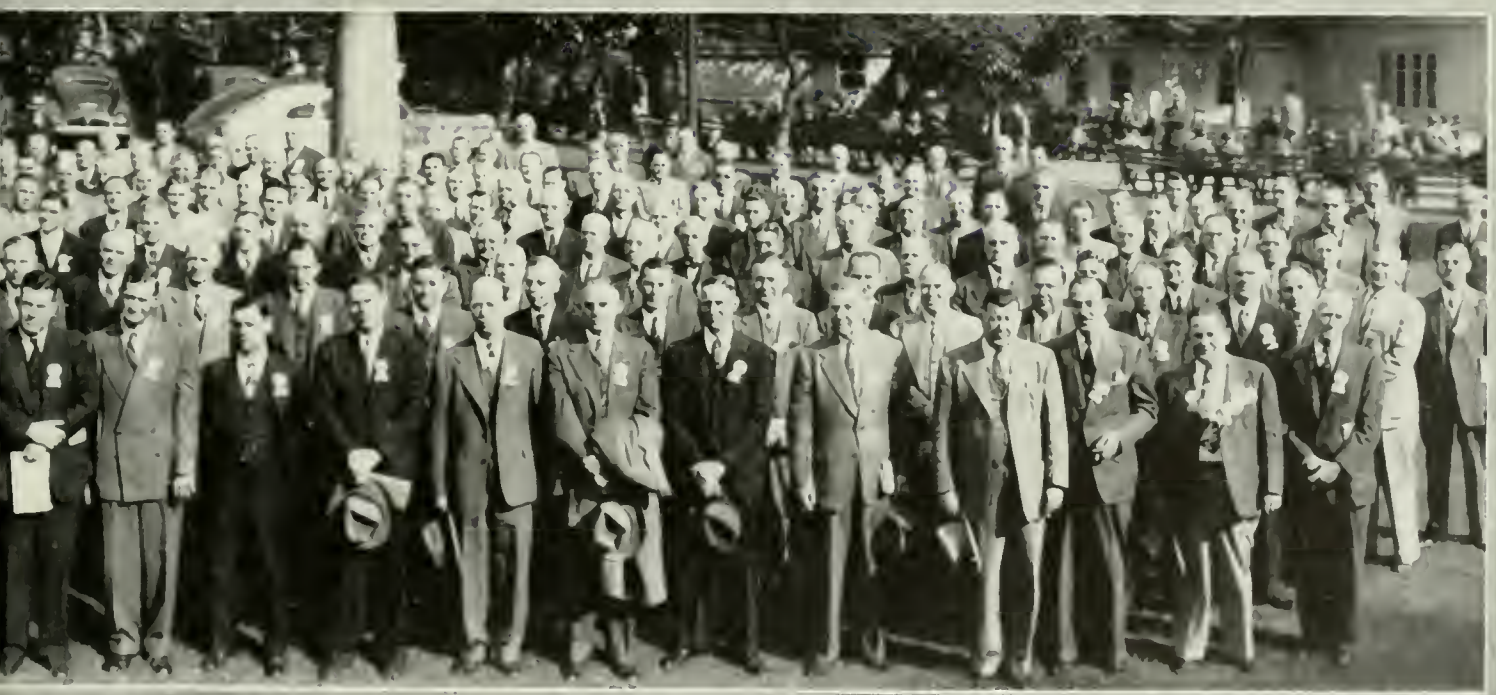
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AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS

ANNUAL MEETING ISSUE
JANUARY 1947

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director GEORGE T. McCOY, State Highway Engineer K. C. ADAMS, Editor

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American Association of State Highway Officials Maps Attack on Postwar Highway Problems

AT WHAT was considered its most important meeting since it was founded, the American Association of State Highway Officials at its thirty-second annual session in Los Angeles, December 17th-20th, laid out a program of action to overcome the multitude of highway construction problems with which it is confronted.

Some 900 delegates, representing the United States, Puerto Rico, Hawaii, and the United States Public Roads Administration of the District of Columbia were in attendance.

At the conclusion of four days of intensive work, the association elected C. W. Phillips, Commissioner of Highways and Public Works of Tennessee, its new President to succeed M. J. Hoffmann, Commissioner of Highways of Minnesota.

Other officers elected were: First Vice President, R. H. Baldock, Chief Engineer, Oregon State Highway Department; Regional Vice Presidents, Spencer Miller, Jr., Highway Commissioner, New Jersey; F. Elgin Bayless, Chairman, Highway Commission, Florida; W. W. Polk, Illinois, and Clarence B. Shain, Director of Highways, Washington. Mr. Miller and Mr. Polk were reelected.

Three new members of the executive committee of 10 were elected as follows:

R. H. Leavitt, Chairman, Highway Commission, Utah; C. H. Sells, Superintendent of Public Works, New York, and F. R. White, of Iowa.

Hal H. Hale of Washington, D. C., and G. H. Henderson, Principal Highway Engineer of Rhode Island, succeeded themselves in their respective positions of executive secretary and treasurer.

NEW YORK NEXT MEETING PLACE

The Executive Committee voted to hold the 1947 meeting in New York State. The State Highway Department of New York will designate the city where the session will be held.

Committee meetings, the President's luncheon for the Executive Committee, a session of the Western Association of State Highway Officials, and the Executive Committee dinner for new commissioners and new chief engineers of member departments attending an association meeting in this capacity for the first time preceded on Friday, Saturday, Sunday, and Monday, December 13th-16th, the opening of the general session in the Biltmore Hotel on Tuesday, December 17th.

Highlights of the morning and afternoon meetings on this date were the annual address of President Hoffmann, presentation by F. R. White, Chief Engineer, Iowa State Highway Department, of a testimonial to Past President H. A. MacDonald, addresses by Thomas H. MacDonald, Commissioner, Public Roads Administration; Representative J. W. Robinson, Utah, Chairman of the House Committee on Roads, and Congressman Paul Cunningham of Iowa, and the reading by D. C. Greer, State Highway Engineer of Texas, of a paper prepared by Major General Philip B. Fleming, Administrator, Federal Works Agency, who was unable to attend the meeting. The addresses of Mr. Hoffmann, Mr. MacDonald, and General Fleming may be found elsewhere in this issue of California Highways and Public Works.

GENERAL SESSION

The general session Tuesday morning was opened by President Hoffmann, and following an invocation by Dr. Louis T. Talbot, Pastor, Church of the Open Door, the delegates heard welcoming addresses from Mayor Fletcher Bowron of Los Angeles and C. H. Purcell, Director of the State Department of Public Works and Chairman of the California Highway Commission, representing Governor Earl Warren, who was unable to attend because of prior official commitments.

In his talk Commissioner MacDonald said that the "limited access highway," a term interchangeable with express way, parkway, and freeway, is the only possible means of coping with urban congestion and that adequate parking facilities must be made an integral part of any over-all plan.

In approving Mr. MacDonald's advocacy of freeways, Congressman Robinson expressed the opinion that bond issues for freeways by cities to be amortized out of federal aid and matched by state funds were feasible and said he believed that existing law will support such financing. He urged a definite long range program by federal, state, and local governments to provide for highways through congested metropolitan areas.

RESOLUTION

COMMENDATION OF DIVISION OF HIGHWAYS OF CALIFORNIA DEPARTMENT OF PUBLIC WORKS IN ITS HIGHWAY IMPROVEMENT PROGRAM

WHEREAS, During the past year the State of California, through its Legislature and in cooperation with the Division of Highways of the Department of Public Works, has completed comprehensive and thorough factual studies of future highway needs, utilizing the products of highway research and survey; and

WHEREAS, The members of this association, as guests of California at their annual meeting in Los Angeles, December 17-20, have had opportunity personally to see the results of these studies and to observe the manner in which the basic data underlying the highway improvement program have been made widely available to all public officials, legislators and the general public in the State, as a means of assuring sound determination of the future program; now, therefore, be it

RESOLVED, That the delegates of the American Association of State Highway Officials, desire to express their commendation to the State of California, and particularly to the Legislature and the Division of Highways of the Department of Public Works, on these studies, and to express also its gratitude to the California Division of Highways for making it possible on this occasion to view at first hand some of the excellent activities the State is carrying forward in this important field.

RESOLUTION No. 1

WAR SURPLUS ROAD EQUIPMENT

WHEREAS, There exists a serious shortage of equipment needed for the maintenance of public roads and streets, particularly such equipment as motor graders, tractors, scrapers, passenger cars, light and heavy duty trucks; and

WHEREAS, Lack of equipment is making it necessary to defer much needed repair and rehabilitation work accumulated during war years and aggravated by increased traffic since the close of active war; and

WHEREAS, The safety and well-being of the increased volume of traffic now using public highways requires that increased efforts be made to restore, repair and maintain public highways; and

WHEREAS, The agencies of the states and their subdivisions charged with the responsibility for maintaining public highways are unable to obtain the necessary equipment from private sources; and

WHEREAS, The present method of distribution of surplus war commodities has resulted in very little benefit to the agencies of the State and their subdivisions; therefore be it

RESOLVED, That the American Association of State Highway Officials request and urge the allocation of equipment be made to states and their subdivisions on the basis of a fixed percentage of the total amounts available; be it further

RESOLVED, That copies of this resolution be forwarded to Members of Congress, with a request that consideration be given to remedying the situation as suggested, or in some other manner that will result in the states and their subdivisions securing a fair share of surplus war commodities.



Mayor Fletcher Bowron of Los Angeles welcomes delegates to the meeting of the American Association of State Highway Officials. Seated, left to right: C. H. Purcell, Director of California Department of Public Works; Thomas H. MacDonald, Commissioner, Public Roads Administration; and Congressman J. W. Robinson, Utah

COMMITTEE MEETINGS

On Wednesday throughout the day important sessions were held by the Committees on Bridges and Structures, Administration, Maintenance and Equipment, Planning and Traffic Engineering, Road Design, Highway Transport, International Highway Relations, and Public Relations and Publicity.

During the noon recess, the delegates were guests at a luncheon in the Biltmore Bowl of the Right of Way Association.

Addressing the Committee on Bridges and Structures, Professor John S. Worley of the University of Michigan, voiced the belief that bridges on the interstate highway system should be capable of supporting the same maximum load as other portions of the system.

Professor Worley pointed out that once constructed, the interregional highway system would be relatively permanent and that highway engineers should project their thinking into the future 75 years to 100 years, rather than think in terms of two or three decades. To construct bridges with the same rated capacity as the paved portions of the interregional system would require the expenditure of only about 2.7 percent additional funds.

"Sound engineering calls for a structure with no weak parts," he commented. "The development of highway transport 50 years hence is unknown, but great advances are certain. The interstate highway system once built fixes the pattern of highway transport for the next 75 years.

"Future military needs are unknown. It seems certain that there will be much greater demand for highway transport than in the war just closed. Highways for carrying heavier military vehicles are probable. The government has just released information regarding a new tank which weighs 200,000 pounds.

"Future economic growth of the country should not be stymied by a restricted highway system. The national and state policies should be to give opportunity for natural growth, rather than a throttled existence. The policies should be to meet potential future needs rather than current pecuniary savings.

"The Interstate Highway System probably never would have been recommended had its construction been dependent upon economic justification. Evidence indicates that construction of the Interstate System cannot rest solely upon economic justification and must rely in part on public welfare—faith in America's future.

"The small additional cost—less than 3 percent—calls for bridges with carrying capacity approaching the other parts of the highway. This is sound engineering, sound administration and sound public welfare."

TRAFFIC SURVEY TECHNIQUES

E. H. Holmes, Chief, Division of Highway Transport Research, Public Roads Administration, Washington, D. C., addressed the Committee on Planning and Traffic Engineering on the subject "What Can Factual Surveys Contribute to Solution of Urban Area Traffic Problems." He said in part:

"New traffic survey techniques have been developed during the last three years which make it possible to forecast with complete accuracy the future daily travel habits of any metropolitan area.

"The new type of survey was developed by the Public Roads Admin-

RESOLUTION No. 2

EXTENSION OF TIME FOR AVAILABILITY OF FUNDS UNDER FEDERAL AID ACT OF 1944

WHEREAS, The Federal Aid Highway Act of 1944 authorized the apportionment of certain funds for each of the first three sucessive post-war fiscal years for federal aid highways, for federal aid secondary roads, and for projects on the Federal-Aid Highway System in urban areas; and

WHEREAS, Section 4(d) of said act provides that any sums so apportioned to any state shall be available for expenditure in such state for only one year after the close of the fiscal year for which it is apportioned and that any sum so apportioned that remains unexpended at the end of such period shall lapse and revert to the Treasury of the United States; and

WHEREAS, The aforesaid provisions of Section 4(d) of said act will operate to cause each state to lose any portion of such funds apportioned to it for the first postwar fiscal year that may not be expended by June 30, 1947; and for the second postwar fiscal year not be expended by June 30, 1948; and for the third postwar fiscal year not expended by June 30, 1949; and

WHEREAS, The Highway Departments of many of the states are certain that the elements of inflation and the acute shortages of labor and engineering personnel materials and equipment that are known to exist will make it impossible to have these funds expended within the time now prescribed by said Act, notwithstanding said highway departments and the public generally realize that the need for the expenditure of such funds on highway work is, and will be, more intensified by reason of obsolescence, deterioration, increased unit costs, and ever mounting traffic volumes; therefore, be it

RESOLVED, By the American Association of State Highway Officials, in annual convention assembled, that the Congress of the United States is hereby petitioned to enact suitable legislation to extend the periods of availability of such funds for twelve (12) months after June 30th of each of the years 1947, 1948 and 1949, and that the executive secretary of this association is hereby instructed to transmit a copy of this resolution to the President of the Senate and to the Speaker of the House of Representatives of the Congress of the United States, and to the Federal Works Administrator and the Commissioner of Public Roads of the United States, respectively.

istration, assisted by the U. S. Bureau of the Census, and has been conducted in 54 cities in 26 states. It uses a scientific sampling basis.



Retiring AASHO President, M. J. Hoffmann chats with Commissioner Thomas H. MacDonald, U. S. Public Roads Administrator

"By interviews with people in their homes, on the streets and at destination points, the survey discovers how many trips are made each day, where they start, where they end, their purposes, and type of transportation. Other data are gathered on where people work, their recreation habits, and parking requirements.

"The surveys have disclosed that in most cities, up to half of the traffic found in the downtown area is there only because the layout of the street system has forced it to be there, adding to the general congestion and delaying its own travel.

"Other typical findings are:

"In the average city, three-quarters of all automobile trips are made by drivers having both origin and destination within the city, but traffic coming into the city from outside accounts for 40 percent of the city's total vehicle mileage;

"Short-time parking spaces can't be used to more than 80 percent of their theoretical time capacity, because of time lost in parking and unparking;

"Downtown department stores under present traffic conditions find one parking space used by their patrons for every 1,000 square feet of floor area, compared to one for every 300 square feet for suburban shopping areas.

"The trouble is that too many surveys are made and then not fully used in planning city traffic facilities.

"Of the 54 cities where the new surveys have been made, reluctantly it must be admitted that the uses made of the data have been disappointing.

"The most commendable job, and one that stands conspicuous in its field is the survey in Fort Wayne, Indiana, recently reported by the Indiana Highway Commission.

"A 10-year program for expressways, parking facilities and other improvements to meet Fort Wayne's future highway transportation needs has been completed."

Freeways are essential to safety, David M. Baldwin of the National Safety Council, told the Committee on Planning and Traffic Engineering.

Baldwin made known the conclusions derived from a joint research project of the Council and the U. S. Public Roads Administration. The report covered 9,000 traffic accidents in 10 states and records of 4,000 miles of major highways.

"Two-lane pavement can safely carry relatively light volumes of traffic," Baldwin said. "But the accident rate increases as the volume of traffic increases up to the point of congestion. On roads carrying more than 9,000 vehicles a day, the accidents actually decrease because of the congestion.

"The rate goes sky-high on three-lane highways; about three times higher than the accident rate on four-lane highways. Generally speaking, curves in a road are not more hazardous than straight roads But the worst record is found on sharp curves. The width of the pavement is a major factor in accidents. The accident rate on pavements less than 18 feet wide was

RESOLUTION No. 3

FOR CANCELLATION OF RESTRICTIONS ON DISTRIBUTION OF CONSTRUCTION EQUIPMENT

WHEREAS, The rehabilitation and expansion of the highway systems of the Nation are vital to the continuing health, safety and welfare of the people of the nation; and

WHEREAS, The various states and subdivisions of government are prepared with plans and finances to commence the reconstruction and construction of these transportation arteries but are prevented, in part, from so doing by the insufficiency of adequate construction equipment which, while being manufactured, is not freely distributed to the construction agencies capable of performing these operations of highway restoration; and

WHEREAS, One of the impediments to the free flow of this needed construction equipment from the manufacturer to the constructor is the restriction imposed by regulations of the Civilian Production Administration concerning priorities and methods of distribution for such equipment; and

WHEREAS, It is the opinion of the American Association of State Highway Officials, in meeting assembled, that free and untrammeled operation of equipment manufacturing and sales processes will make possible the acquisition by the construction industry of the equipment required for this necessary work; now, therefore, be it

RESOLVED, That the American Association of State Highway Officials recommend to the Civilian Production Administration and other governmental agencies the immediate cancellation of all rules, regulations, orders, directives and any other restriction on the free manufacture, sale and distribution of construction equipment and machinery and its component parts; and be it further

RESOLVED, That copies of this resolution be sent to the Civilian Production Administration and to other appropriate federal agencies having jurisdiction of the distribution of such equipment.

50 percent higher than on those 20 feet wide or wider."

Thursday was devoted to meetings of the Committees on Materials, Uniform Accounting, Road Construction, Planning and Traffic Engineering, Road Design, Use of Radio in Highway Departments, Right of Way, Highway Research Activities, and Legal Affairs, together with a panel discussion on State-wide Planning Surveys in the afternoon.



Director of Public Works C. H. Purcell, who is also Chairman of the California Highway Commission, extends to the AASHO the greetings of Governor Earl Warren, who was prevented from attending the meeting by official business

At the meeting of the Committee on Legal Affairs a paper on the subject "Controlled Highway Access Court Decisions and Their Effect on Actual Right of Way Acquisition" was read by C. C. Carleton, Chief Attorney of the Department of Public Works of California.

An unusually large number of attorneys and right of way representatives from the several states and territories was in attendance.

Among the out-of-state counsel who participated in the discussions were J. M. Devers, Chief Counsel, Oregon State Highway Commission, Chairman of the group; Judge L. E. Boykin, Solicitor of the Public Roads Administration, Washington, D. C.; C. Nils Tavares, Attorney General of the Territory of Hawaii; Tom W. Holman, Chairman, Washington State Highway Commission; and H. A. Cohen, Contract Attorney of the Highway Department of the State of New York.

The practical effect of recent court decisions on the field work of acquiring lands and right of way for modern highway development was analyzed by the various speakers.

Numerous other legal topics of interest to the gathering, and relating to highway matters, were presented for open forum discussion.

Also, it was the consensus of the meeting that plans should be formulated whereby the Committee on Legal Affairs could be of more all-year service to the American Association of State Highway Officials and its members.

The thirty-second annual meeting was officially adjourned at noon, Friday, December 20th, following the reading of annual reports by the Executive Secretary, Treasurer, and Auditing Committee, and the election and installation of new officers.

During the afternoon the delegates and their ladies were taken on a sightseeing trip, which included a ride over freeway construction projects in Los Angeles, through the industrial area, oil fields, orange groves, and to the beach cities and Los Angeles proper. The inspection concluded with a trip over the Terminal Island Freeway now under construction and a buffet supper at the Riviera Club.

Designs for Interchange of Traffic Streams

By A. M. NASH, Engineer, Surveys and Plans

Designs for the interchange of highway traffic streams were discussed in the following paper read by A. M. Nash, Engineer, Surveys and Plans, California Division of Highways, before the Committee on Road Designing of the American Association of State Highway Officials in session in Los Angeles.

IN PREPARING this paper, I have tried to keep constantly in mind the fact that I would be addressing an audience with a rather comprehensive knowledge of the subject we are considering.



A. M. Nash

Nevertheless, the fact that a discussion on types of interchanges has been scheduled for this meeting, suggests of itself, that all of us feel there is still room for exploration and discovery in the field.

While there are many designs for the interchange of traffic streams (the minds of design engineers being very fertile in this regard), basically, there are only two distinct types—the direct and the indirect. Interchange designs are either pure examples of these types, or what is more often the case, hybrid designs using elements of both.

TWO TYPES OF INTERCHANGES

By "direct interchanges" we, of course, refer to the types which are designed to provide the most direct and natural movement for all segments of traffic without conflict with any of the major movements. Invariably this type requires the provision of multiple structures.

By "indirect interchanges" we refer to the types in which circuity in the paths of the interchange roadways are considered to satisfy requirements. The typical indirect interchange can be accomplished with a single structure, the classic example being the clover-leaf.

An appreciable number of various forms of interchanges have been built in California; but a much larger number exist only on our drawing boards or as a part of completed plans which have not yet been placed under construction, or are now in the process of construction but are not yet in service.

HARVEST OF WAR

This condition is a result of the almost complete shut down of highway building during the war years.

As interchanges are most frequently required and used in freeway or parkway design, and as this phase of highway development was just coming into widespread use in this State at the beginning of the war, the prohibition against highway construction permitted us to conceive and plan but not to build.

The harvest from these four years of arrested highway development is now being reaped in an appalling record of traffic accidents and deaths on our highways.

I have every reason to believe that practically all the highway design departments of the various states find themselves in a similar position to ours, hence, our discussions here will deal, to some extent at least, with types of interchanges which exist as plans rather than as actualities proved in traffic service.

COMMITTEE HELPFUL

I believe we are fortunate indeed to have had the benefit of the analytical thinking and constructive deliberations of the members of the Special Committee on Administrative Design Policies of this association. Their efforts have resulted in the publication of a series of design policy pamphlets which have been of inestimable help and guidance in improving our approach to the design problems with which we have been confronted in preparing our designs for postwar construction.

As a result, I am firmly convinced the designs and plans which we have prepared during the war years and which are now in process of construction into actual traffic service facilities, are immeasurably better conceived than would otherwise have been the case.

I want to confess that, in my opinion, few of the traffic interchanges which were designed and built in this State prior to the war, are completely satisfactory.

I suspect that most of you would report a similar opinion with respect to your experience in your State in the same period.

FORMATIVE STAGE OF DESIGN

This was a natural result, for we were in the formative stage in this phase of design and were learning by trial and error the basic truths on traffic behavior in connection with this problem as well as educating the driver into new action patterns for proper use of the facilities.

I am not so naive as to believe we have found all the answers, or that further driver education is unnecessary. We shall, I hope, continue to experiment, to analyze, and to learn from close observation the mistakes which should not be repeated.

With this preamble, I would like to discuss with you two forms or types of interchanges which were evolved to fit peculiar and rather difficult conditions of freeway interchange design here in the Los Angeles metropolitan area.

FOUR-LEVEL STRUCTURE

I have chosen my examples in this locale for the specific purpose of permitting you to supplement our discussions here with a visual examination of topographical conditions at the sites, for they are close to the scene of this meeting.

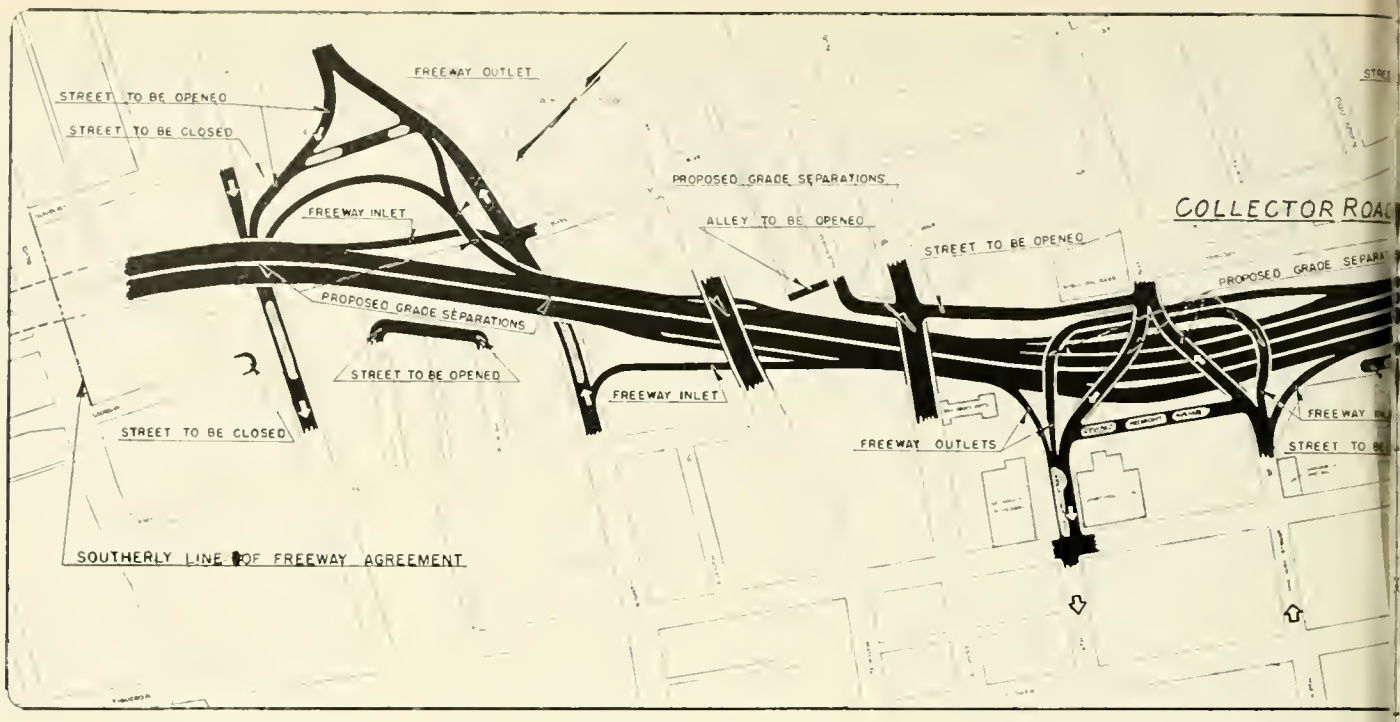
The first of these is the so-called four-level structure, a scale model of which is on display at this convention.

Here we have the meeting place of two major freeways, the Hollywood and Harbor Parkways.

The site location has severe limitations, and the traffic volumes desiring to interchange will be very high.

Many designs were studied and discarded as analysis disclosed their deficiencies, before the present adopted plan was evolved.

As you may note by inspection of the model, the major element in this solution was the decision to expand the interchange in the vertical plane to accommodate the interchange move-



This sketch delineates the section of the Harbor Parkway west of the four-level structure between Fir be discharged and collected the largest possible volume of motor vehicles at concentrated peak periods. The ske practicable, for outer highway use and for local interchange approach to ramp and crossover facilities. Many l

ments. By separating the movements in this fashion, the following desirable attributes are attained.

NO GRADE CROSSING CONFLICT

The design provides complete interchange of all movements without grade crossing conflict. Through traffic on the two freeways has preferential roadways with no deviation from straight courses. Right turns are natural movements in their respective quadrants, while left turns are required to make only the minimum deflection from straight paths. A studied feature of the design is the symmetry and uniformity of all roadways from points of departure to points of convergence. Every movement, considered by itself or viewed in relation to the whole layout, is simple and uncomplicated. A driver must make but one choice to select his desired path and thereafter his course cannot possibly be distracted from its destination. Moreover, the driver departs via right-hand lanes and enters into right-hand lanes, a very desirable requirement.

Local conditions dictated this eventual solution as to form of interchange, the type being direct throughout because of the large volumes of expected traffic.

The intersection of these two major parkways was inflexibly fixed by approach conditions through lines of least resistance in one of the most highly developed sections of the city. In addition, the intersection area was limited to the minimum because acquisition of rights of way entailed destruction of large buildings and was unusualy expensive. Adjacent streets of importance had to be preserved and fitted into the ultimate plan, and ground topography was irregular. Traffic would be capacity loads in all quadrants and would demand complete interchange provisions.

These factors dictated the solution, for everything was against lateral expansion with its large space requirements, and we feel the adopted design was a happy one and admirably fits the site.

The Harbor Parkway also furnishes another example of an unusual solution of an extremely complex problem in interchange design.

HARBOR PARKWAY

To illustrate better the factors involved, I have had this sketch prepared which I hope all of you can see. It delineates the section of the Harbor Parkway west of the four-level structure between First and Ninth Streets.

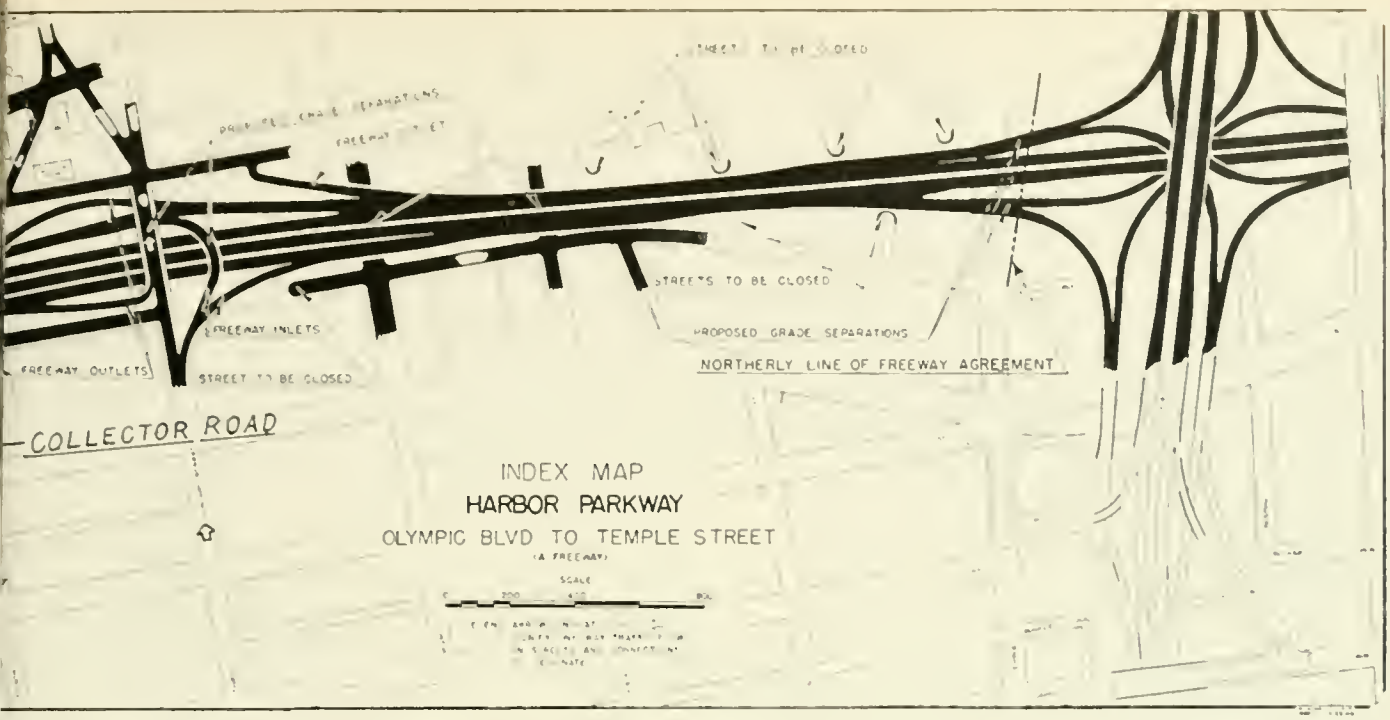
This area comprises the heart of the business section of Los Angeles, where will be discharged and collected the largest possible volume of motor vehicles at concentrated peak periods.

Because of the close spacing of the intersection streets, it would obviously be impossible to provide interchanges at each street with traffic flow in both directions thereon. The number of ramp connections required would have been a maze, with indirection and circuity of travel the rule, let alone the lateral space requirements in an area of extremely high property values. Moreover, it would have been impossible to maintain the desirable maximum of four lanes in each direction on the freeway proper.

COOPERATION OF CITY

The first step in the solution was to obtain the cooperation of the city in restricting the main cross streets in the area to one-way traffic, alternately east or west on successive streets.

The next problem was to provide for the entrance or exit from the freeway, of the huge peak loads expected without too severely penalizing the traffic on the freeway. Our solution has been what we have termed a "collector" road, lying parallel to the freeway proper, into which the traffic will first



Tinth Streets in Los Angeles. This area comprises the heart of the business section of Los Angeles, where will rates one of the adopted principles of the California Division of Highways of utilizing existing streets, where practice affords direct movement in lieu of artifices that must be of an indirect character.

enter, or exit, and adjust its speed either faster or slower as the case may be, before proceeding into the fast-moving freeway traffic stream or into the slower-moving traffic on the desired one-way street leading to its destination. These "collector roads" thus will serve as magnified speed-change lanes, as well as adjusting and smoothing the flow of the traffic streams entering and leaving the freeway, with a resulting minimum of conflict with the traffic already in the freeway traffic stream.

The ramp connections are to and from these "collector roads," which have all the elements of the freeway proper.

Another desirable element which this design provides is the longer spacing between successive entrances and exits to and from the freeway than would have otherwise been necessary by use of the usual conventional designs.

Here again, we find design limitations forcing the designer to look beyond the conventional for a solution to his problem, and in the process, evolving what, we believe, is a far better answer than could have been produced by too rigid adherence to the usual approach.

This sketch, incidentally, illustrates one of our adopted principles of utilizing existing streets, where practicable, for outer highway use and for local interchange approach to ramp and crossover facilities. Many times this practice affords direct movements in lieu of artifices that must be of an indirect character.

I would also like to call attention to the fact that the system of overpasses, as determined by ground elevations, places the crossing streets in favorable position for readily signing and directing movements from and to them. The spacing of ingress and egress points for road connections and dispersals, with one exception, allows plenty of time for the motorist to pick up the directions, one at a time.

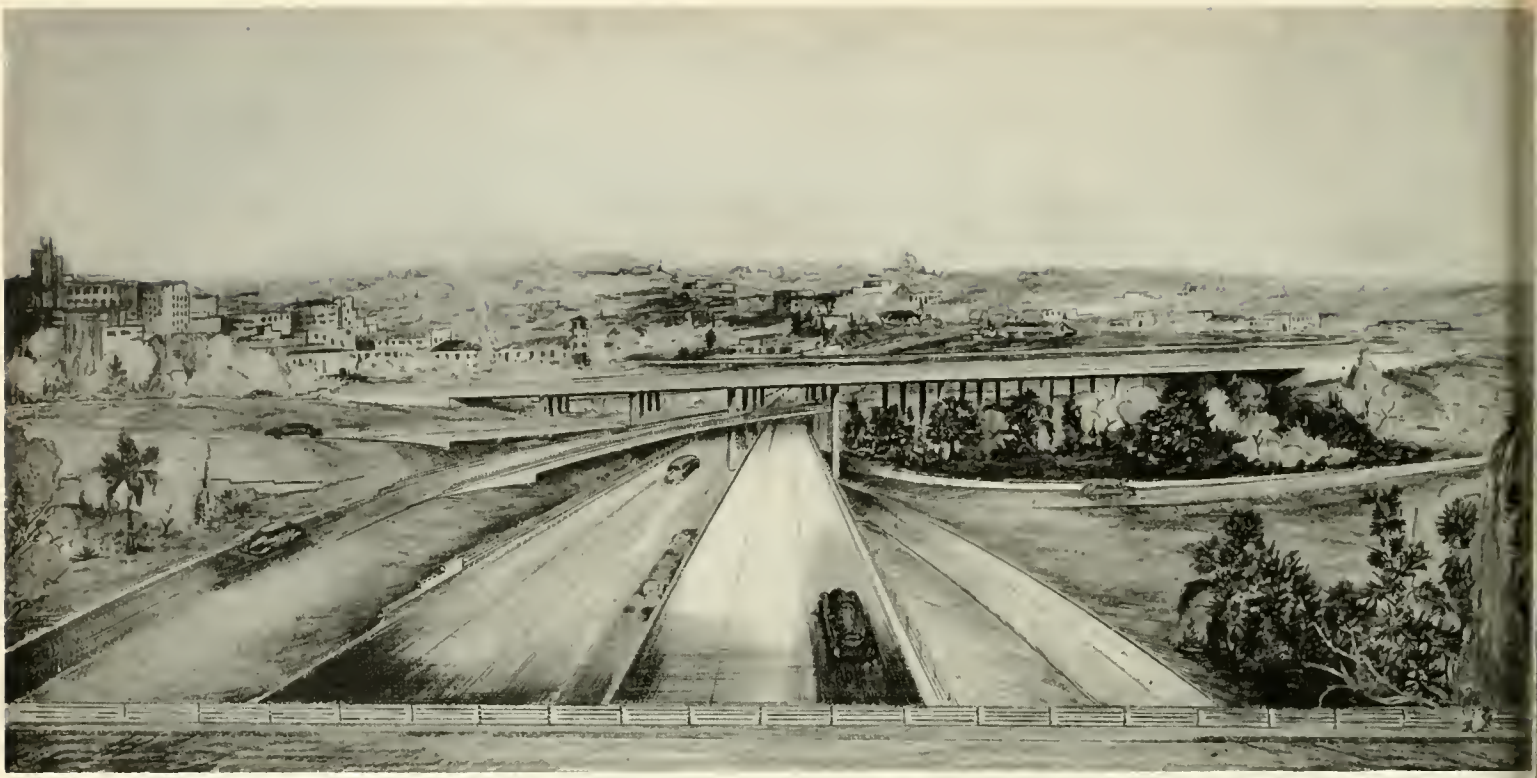
The one exception is for a relatively light traffic movement, where the users will be mostly "repeaters" and, hence, this departure from desirable practice is not considered sufficiently serious to justify the large expense required for its elimination.

While I am on this subject of signing, it is our opinion that the perfection of an interchange design can often be judged by determining how readily and completely it can be signed. In my judgment, it is a sure indication of weakness in design if there is difficulty in properly placing direction markers. It is a basic rule of good signing practice not to give a driver more than one instruction at a time and the space between signs should allow him time to assimilate and respond to one instruction before giving him another.

A frequent design error, which we try to carefully guard against, is to allow the sense of proportion to be lost in drafting to a large scale and neglecting to check on distances between points of traffic divergence. Distances between turning points or junctions of ramps and roadways must always be checked against design speed so that the driver may read, comprehend, and act as he goes forward.

Careful regard for aiding the public in interpreting the proper use of highway facilities should also include a studious adherence to uniformity of design, especially uniformity in interchange features. Uniformity of treatment must be studied for consistency of approach and application over the entire route rather than with regard to one site irrespective of any other site.

It is recognized that complete uniformity is often impossible at reasonable outlay because conditions at sites differ; but if the fundamental verity of simplicity be our guiding star, it is my belief that uniformity from the driver's point of view will usually result.



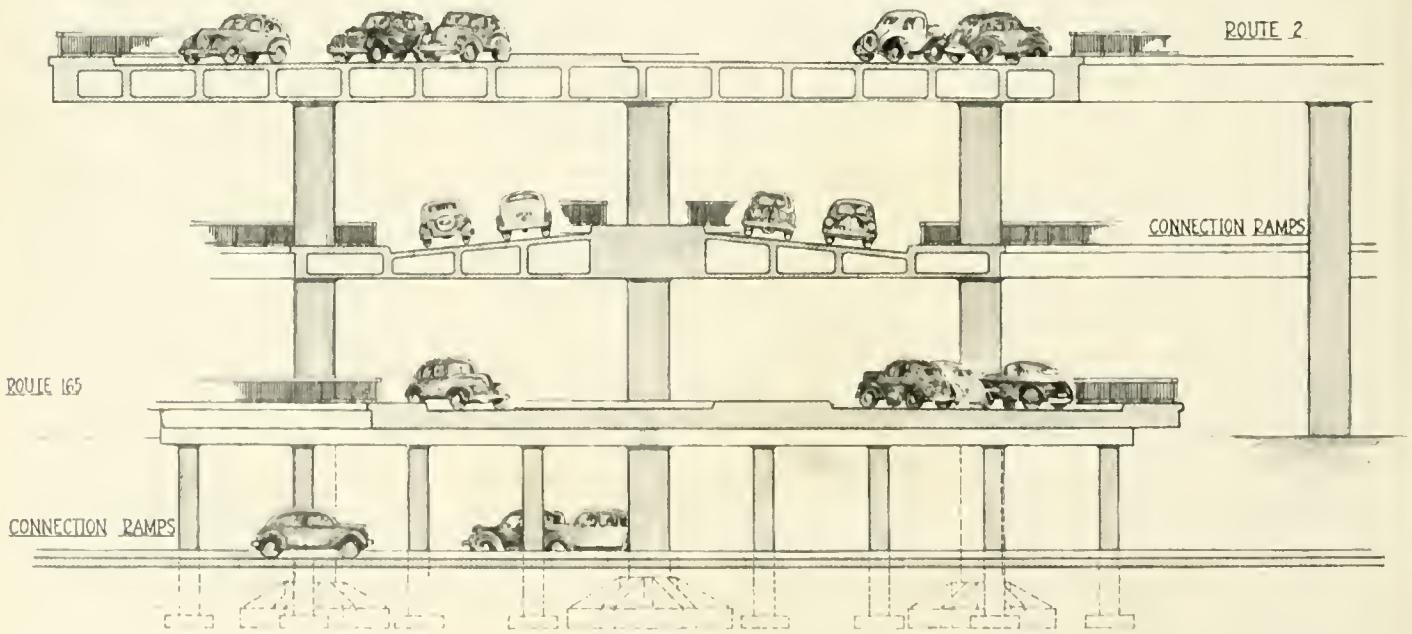
Artist's sketch of proposed 4-level grade separation in Los Angeles of State Highway 165, Arroyo Seco-Harbor Parkway, shown as the broad six-lane divided highway in center of picture and Route 2, Hollywood Parkway, crossing the picture at top level. The other roadways are traffic interchange connections with the two major arterials.

Simplicity of design should be the goal of every interchange design solution and will shine as the sun from every exhibit we see illustrating a commendable project.

In this regard, many otherwise simple and sound designs are too often cluttered up and unnecessarily complicated by the designer's attempt to take care of a minor and unimportant traffic movement that could just as well be required to occur at some other place with only small inconvenience resulting to a limited number of drivers.

Complications often arise from an attempt to extend the "Freeway Principle" to connections to and from city streets or local roads. In many instances the elimination of left turns or cross movements on local streets or roads at the terminal end of ramp connections results in costs out of proportion to the benefits afforded.

Cross section sketch of 4-level structure showing traffic on two major highway routes and interchange ramp connections crossing at one point



California Experience and Practice In Highway Pavement Foundations

By R. M. GILLIS, Construction Engineer

The following paper was read before the Committee on Road Construction at the American Association of State Highway Officials meeting in Los Angeles by R. M. Gillis, Construction Engineer of the California Division of Highways.

THIRTY years ago this State was laying four-inch pavement on native soils or existing roads, about the only base preparation being to scarify and roll the base. After 10 years or so these pavements were broken enough to cause comment and a complete survey was made by the Bureau of Public Roads and a comprehensive report made by Dr. Hewes. An interesting point brought out by this survey was not the number of pavement failures but rather the number of miles that were still in useable condition. However, it was definitely recognized that both pavements and foundations would have to be more substantial.



R. M. Gillis

In studying this problem, the Laboratory, under the direction of Mr. T. E. Stanton, developed the California Bearing Ratio test. Most of you are familiar at least with the general principle of this test, and we have not the time to go into it. By accumulating a record of the C.B.R. values for bases of failed pavements and bases of sound pavements there was built up a graph to show that thicknesses of base and surface might be expected to carry traffic.

TEST TRACK EXPERIMENTS

In 1940 this study was amplified by a test road and the Laboratory is just now completing studies on a second test track, working to determine the number of load repetitions that would be required to produce failure for a given thickness of base and surface. Also, studies are being made on other possible tests to measure the supporting power of soils and consideration is being given to other soil properties that possibly should be measured.

Because of its experience with increasingly heavy planes, the U. S. Army has made and is making extensive tests along the same lines but with far heavier loads than are permitted on highways. One of these tests is now nearing completion at Stockton, California. They should give us valuable information on our problem.

TRUCK TRAFFIC INCREASES

Studies by the Public Roads Administration confirm the belief that trucks of the larger sizes are more numerous in California than in other states. In 1944, for-hire trucks received two-thirds of every freight dollar in California. From 1930 to 1940, commercial vehicles (trucks and buses) increased from 99,387 to 248,388, or 150 per cent. The average maximum axle loading increased from 6,622 pounds in 1936 to 11,995 pounds in 1944. During the war years, the total traffic on California highways dropped to 70 per cent of the 1941 figure, while at the same time the number of trucks was greater (this does not include military convoys). It should also be noted that since many of these trucks have more than two axles, the increase in loaded axles is still greater. With the roads taking this kind of punishment, you will understand why we are worried about pavement foundations.

As the traffic and the wheel load repetitions have increased, an effort has been made to keep pace with the design. Among the points along this line that might be mentioned are:

1. Requirements have been raised for coverage of ground with a given supporting capacity.
 (a) C.B.R. test has been stiffened.
 (b) The thickness of base and surface required for ground of less than 5 C.B.R. is now 24 inches. The base may be secured from selected cuts on the job, from a pit outside the limits of the contract, from a commercial source, or from a combination of these sources.
 (c) A few years ago, we accepted 20 CBR as adequate immediately under PCC pavement; we now try for at least a 50 CBR. Where 50 CBR was formerly accepted under A.C., an effort is now made to get 80 CBR (the equivalent of crushed rock).
2. The Plasticity Index has been added as a requirement for base material—generally less than 6 being specified.
3. Compaction requirements both for the base as well as material below it have been increased.
 (a) Standard specifications now require 90 percent relative compaction for all fills; in addition the top $2\frac{1}{2}$ feet below grade is placed in 4-inch layers which with most materials will give a relative compaction of over 95.
 (b) In cuts where material has less than 90 relative compaction, the cuts are rolled or if necessary are taken out and replaced in 4-inch layers to insure compaction at least $2\frac{1}{2}$ feet below profile grade.

FREEWAY CONSTRUCTION

It is hoped that you will be able to take the trip scheduled to go over the Santa Ana Freeway and the Terminal Island Access Road contracts now under construction. On the Santa Ana Freeway, still in the grading stage, the contract calls for 8-inch PCC pavement (with no expansion joints); under the pavement will be 6 inches of untreated rock, 2-inch maximum size, 50 CBR, less than 1 percent expansion and less than 6 P.I.; under the rock

(Continued on page 28)

Evolution of Culvert Design

By R. ROBINSON ROWE, Senior Bridge Engineer

The following paper was read at the AASHO meeting by Mr. Rowe, California Division of Highways.

THE CULVERTS I remember as a boy in Michigan were rather small stone arches built by township road commissions from plans they carried in their heads and passed on from generation to generation. The ingredients were lots of stone and horse sense assembled in a stout manner. If there were blueprints and engineering behind the designs, the matter was a township secret.

Since then I have wondered about the origin of culverts, just as I wonder now about the future of them. The best information I have is that bridges and culverts, by those names, developed in England and that they borrowed the name "bridge" from the Scandinavian and "culvert" from the Norman French. The Normans called it a *couluerre-vertie,* the *coulnerre* being a side gutter and the *vertic* showing that it had been turned transversely. The culvert, then, is simply a cross-gutter. That is, it was; we all know how it has been growing lately.

TRANSFORMATION OF CULVERTS

The culverts I remembered were 12 to 15 feet long under one-way roads that dipped deep into gullies and barely cleared the keystones. Most of the traffic was horse-drawn and there was no fuel tax on hay to pay for high roads over the gullies.

Culverts have grown as highways have grown. At first the growth was moderate and highway departments adapted railroad designs, both box and arch culverts, to highway needs. Then, as earthwork became cheaper and cheaper and traffic demanded smoother alignment and grades and backed the demand with more and more money, the culvert was buried deeper and deeper in the gully embankment. For every foot the highway was widened, one foot was added to the length of the culvert, but for every foot the grade was raised, the culvert grew by three.

Lengthening the culvert was no great problem at first. We had standard plans, so that it cost no more to design one 50 feet long than 15 feet long. Supporting the weight of high embankments was a more difficult problem, for which the usual solution was a stout and safe but costly overdesign. The importance of cost increased with length. To reduce cost it became essential to determine more precisely the hydraulic and structural duty of the culvert.

The evolution of the culvert is now in that phase and engineers in many of the states are devoting much time and thought to economy of design. This paper is limited necessarily to a very small part of the practice. First of all, it is limited to the practice governed by Bridge Specifications of AASHO, that is, to monolithic and sectional-plate structures. Second, particular attention will be given to the larger waterways under very heavy and compact embankments. Finally, more consideration will be given to hydraulics than to hydrology, and to earth loads than to stresses.

HYDRAULIC DESIGN

Hydraulic design of culverts has been handicapped by a number of difficult hurdles. One of the highest is due to the inclusion of the study of hydraulics in the field of mechanical engineering, whereas the study of highways and bridges is in the field of civil engineering. Then the principles of hydraulics must be applied to a most complicated combination — debris-laden flow through a part-full conduit at varying depth and velocity.

The association's specifications require or strongly imply that such flow through a culvert shall be "without head." This archaic principle is still acceptable for short culverts, but for long culverts it is uneconomic and largely the cause of difficult hydraulic computations. Several years ago, California inquired of the other states and found that design "without head" was nearly universal, but that flow under head was very common and not particularly undesirable.

As this confirmed our observations, we have chosen to interpret this specification rather freely. The interpretation has been published, but a brief summary will introduce some further thoughts on the subject. We consider that frequent flow under head involves undesirable risk of blocking by debris or erosion at the extremities of the culvert and therefore require that flow will be without head for a 10-year flood. This requirement usually fixes the minimum waterway at the entrance.

THE 100-YEAR DESIGN FLOOD

We then conceive of a 100-year flood as the real design flood. For this flood the culvert will usually flow full, so that hydraulic computations are simple, using the well known formulae of the University of Iowa. These computations determine stages and velocities at the extremities so that all appurtenances can be designed for the one extreme flow condition. Although the expression is overworked, we call this system "balanced design."

Use of these two criteria will be illustrated by an example. Suppose the hydrologic study has concluded that the 10-year flood is 100 second-feet and the 100-year flood is 180 second-feet. Our chart shows that a 4 x 4 box culvert will admit 100 second-feet without head on the entrance.

Suppose first that the natural gradient is very flat, so that the design flood of 180 second-feet will pond 8 feet deep at the entrance and that this is objectionable. For this flat gradient we ignore the first criterion and design the culvert with a constant section larger than 4 x 4 so that pondage is just tolerable.

A GOOD DESIGN

Suppose next that the natural gradient is steeper, but less than the neutral slope of 0.009. The culvert will be filled throughout by the 180 second-feet and a constant 4 x 4 section will be a good design.

Finally, suppose that the natural gradient is much steeper than the neutral slope. The 180 second-feet will be ponded by the 4 x 4 entrance, but drop

just inside the entrance, and the rest of the barrel will not be filled. In that case, a 3 x 3 barrel with a 4 x 4 tapered entrance might be adequate and much cheaper.

This procedure is most economical for long culverts, usually under high fills, for which barrel efficiency is more important than entrance efficiency. The proportioning must be done carefully; if the barrel is too large, the cost of the unused waterway will be large; if too small, the cost of enlarging it will be very great. There will also be contingent problems at entrance and outfall, which will be discussed later.

ALTERNATIVE INVERTS

We are studying another difficult problem in barrel design—the best shape for transport of mineral detritus. In our new standard box culverts, we have provided three alternative invert sections for particular situations.

The regular invert is a flat slab without corner fillets. This is the cheapest construction and is satisfactory for clear water—even for turbid water if there is a fair gradient and good get-away.

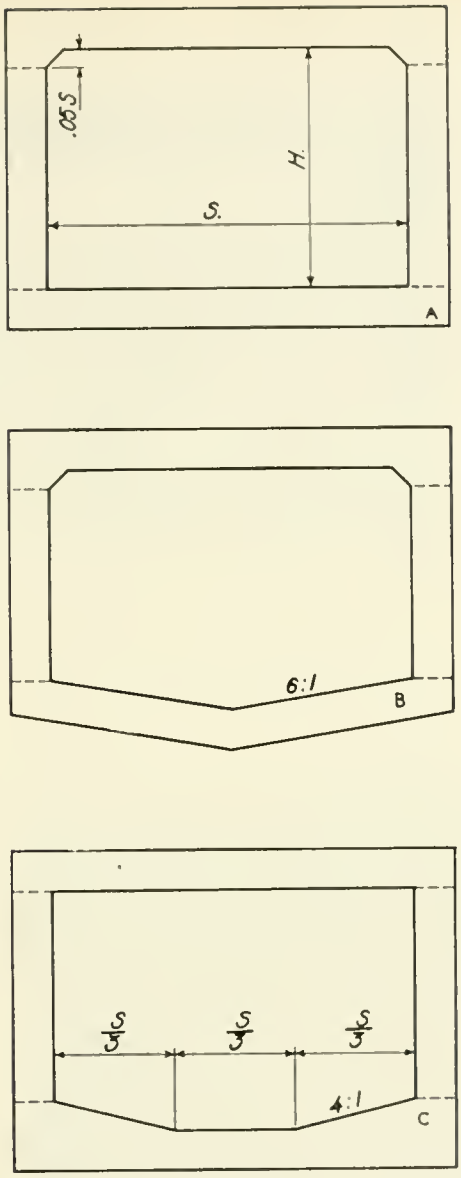
However, if turbid flow decelerates in the barrel because of flat gradient or poor get-away, culverts are clogged by sedimentation, especially on falling stages. Maintenance of such culverts is expensive and there is hazard of great damage if another flood occurs before the culvert has been purged.

The V-invert has been widely used for many years as a partial solution of the silt problem. On the falling stage, flow is deeper in the vee, maintaining a velocity that will transport more of the detritus through to the outfall. We provide the V-invert as a second alternative.

TRAPEZOIDAL INVERT

The third is a trapezoidal invert for boulder-laden streams. When we used flat inverts for such streams, the boulders would be stranded during the falling stage. As the stage continued to fall, finer and finer detritus is deposited around the boulders, building a compact bar that may resist later floods. In some cases V-inverts were used for such streams and the heavier boulders were transported by sliding or saltation along the bottom of the vee, wearing a deep groove in the invert slab.

The trapezoidal section is level for the central third of the invert and inclined with 4:1 slopes on the outer



Alternative standard inverts—(a) Flat invert for nonsilting streams; (b) "V"-invert for silting streams; (c) Trapezoidal invert for heavy bed loads

thirds. This slope can be struck with a screed. We consider this experimental, but expect it to maintain fair velocity on the falling stage and disperse erosion over the central third.

Curved alignment of a culvert raises the question of superelevation required to distribute boulders laterally and prevent erosion of grooves at the lower corners of the culvert. Ordinary formulae will not solve the problem because of the greater density of the boulders. Model studies will be required. Observations made by the Hydraulic Section of District VII in a model built for another purpose have given us some clues to the answer. We have also tried to dodge the issue by using a curved invert section, so that the concentration of boulders would move laterally as stage rose and fell, which provides some measure of dispersion of wear.

FILLETS DESIGNED HYDRAULICALLY

It has been mentioned that fillets are not provided at the lower corners of the barrel, these corners not being considered rigid. At the upper corners we provide the usual fillets and the question of proper size was raised during the design. Since we do not specify a structural value to such fillets, it occurred to us to use hydraulic values by proportioning the fillet to obtain maximum hydraulic capacity. Up to a certain limit, reducing the waterway actually does increase its capacity because of the consequent reduction of hydraulic radius. In terms of span S and depth H of the rectangular box section, the fillet dimension should be:

$$F = \frac{kSH}{S+H}$$

where k is 0.113 for triangular fillets and 0.182 for circular fillets. For standard culverts with triangular fillets, we use the approximation F=0.05S to the nearest inch.

ARTIFICIAL ROUGHENING

Sometimes instead of increasing the hydraulic capacity we wish to diminish it to reduce the energy in the stream at the outfall. Our experiments in this field have been published* and we have nothing to add at this time, but the paper would be incomplete without a brief summary.

If culvert gradient is steep, hydraulic efficiency would call for a very small waterway and very high velocity. There is a reasonable limit for velocity, but if we try to reduce velocity by increasing waterway, the barrel flows part full with velocity still high. The ideal flow regimen would be a filled waterway for most of the culvert, with water surface dropping until there is critical flow and a minimum of energy at the outfall.

Several expedients are workable—roughening the interior surfaces of the culvert, laying the invert grade as a series of long steps, or constructing weirs or baffles on the invert. We have tried the first two, being warned that weirs or baffles would trap debris.

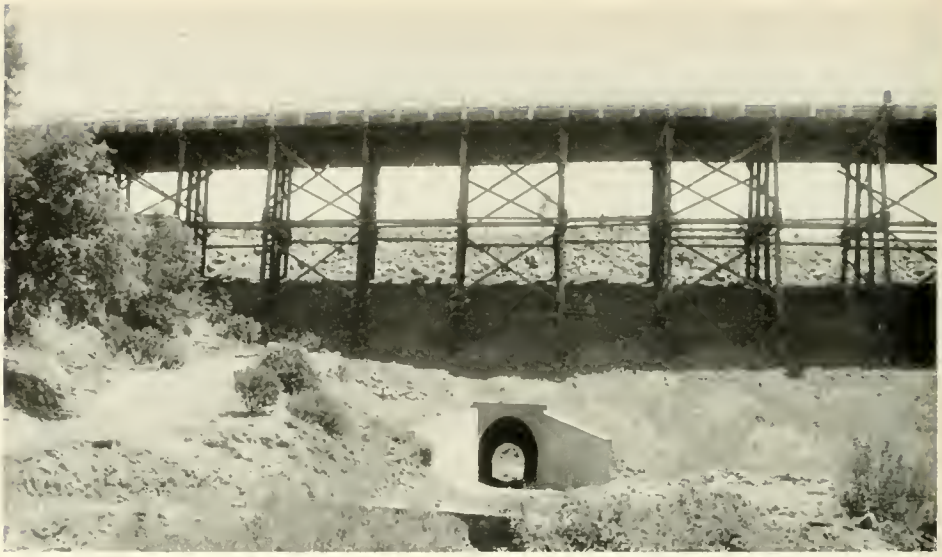
* Proceedings, Highway Research Board, 1943, or California Highways and Public Works, November, 1942.

CONFLICT OF HYDRAULIC AND STRUCTURAL PRINCIPLES

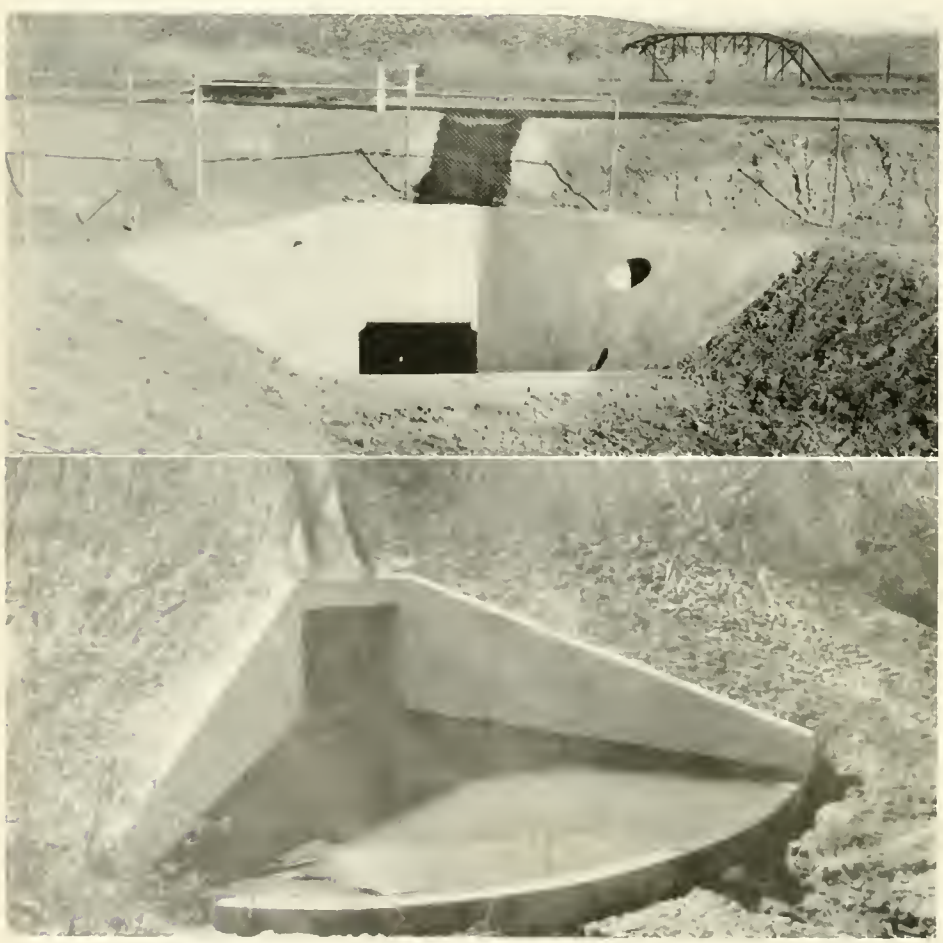
As culvert barrels are designed larger and larger, we find a conflict between hydraulic and structural principles. The shape of the cheapest barrel, say a square box or a high arch, makes an unnatural and dangerous waterway. An example will make that clearer.

Suppose we are designing a box culvert for 1,000 second-feet on a gradient that will support a velocity of 10 feet per second and the natural flow has a depth of five feet. The hydraulic engineer suggests a 20 x 5 box culvert, but the structural engineer points out that a 10 x 10 box would provide the same waterway at much less cost. However, to use the full area, the stream backs up at the entrance and the extra five feet of energy head carried through the culvert may be very destructive at the outlet. If the structural engineer had suggested a high arch culvert, the extra energy would have been still greater.

On special designs, the hydraulic and structural engineers can work out the conflict of principles together. For standard designs we have set up an arbitrary control of waterway shape. In effect, we say that a large culvert barrel consists of two segments, the lower segment being the usable waterway and the upper segment being a structural void. Thus, in the example, the 10 x 10 box has a "rated waterway" of only 75 square feet and would not satisfy the design conditions. The same rule would show two acceptable alternatives, a 12 x 9 box or a 13-foot arch. We express the rule in an empirical formula and show the rating for large standard culverts on the layout drawing.



Replacing old bridge with high-arch culvert at Seaman's Gulch on U. S. 299 in Shasta County



Drop entrance with warped wings (above) and radial bucket outlet (below) on State Route 79 in Los Angeles County

ENTRANCES AND OUTFALLS

We are planning to design standard appurtenances for entrances and outfalls to fit the requirements of long culverts flowing at high velocity. Our ideas of these requirements have also been published and have been incorporated in some special designs. I will give a brief resumé only.

Foremost is the sobering thought that the economy of slenderizing long culverts under high fills is offset, in part at least, by the cost of the appurtenant structures. Alternative designs should compare costs of the entire structure, not those of barrels alone.

At the entrance, the extra cost may be large to prevent detention of detritus. Large drift must be screened from flow entering the convergent throat of a tapered culvert, or it will jam in the throat. Ponding at the entrance may cause deposit of bed load unless the wingwalls and apron form a sluiceway.

At the outlet, the problem is to dissipate the kinetic energy without damage to structure, embankment or downstream improvements. Flared outlets, hydraulic buckets, drops or bank pro-

tection can be used in many combinations.

For either end, we have found frequent use for a transition from the natural trapezoidal waterway to the rectangular waterway of the culvert, using what we call a "warped wingwall." Special designs have developed a wide variety of proportions, but good progress has been made in reducing the variety to a few standard patterns.

STRUCTURAL PROBLEMS

The proportioning of structural sections of culverts differs little in principle from regular problems of bridge design except for the determination of design loads due to weight of overfill and pressure transmitted through the fill from live loads.

At first we were much concerned over inconsistencies in the partly empirical specifications of the association for live-load pressures and we took an active part, with others who were also concerned, in suggesting radical revisions. The failure of a culvert during construction led us to a new policy that eliminates much of the conflict.

This failure called our attention to the expediency during construction of allowing heavy earth-moving equipment to pass over fairly new culverts. For small culverts, we found that a legal live load on a bare slab was more severe than many feet of overfill and decided that all culverts, no matter what the overfill, should be designed for the bare-slab condition. This minimum design governs our new standards throughout most of the range of overfills in which live-load pressures were disputed. This matter, as you know, is being studied by a sub-committee, and we are still looking forward for its report. It cannot affect our smaller culverts, but may permit some revision of the larger ones.

EARTH LOADS

It has long been recognized that a culvert may have to support more or less earth than the weight vertically above it, but engineers have been slow to adopt theories of soil mechanics to rationalize their designs. It may be of interest to review some ideas on the subject as an introduction to our proposals.

Our practice of 18 years ago allowed neglect of overfill above 50 feet. There was no published premise for this policy, but it was usually justified by a vague reference to arch action. The rule was the same for 2-foot spans and 10-foot spans. There was fair agreement that culverts as a rule were overdesigned and many designers felt safe in taking small liberties with load and stress specifications. Modern overfills were compacted to weigh 120 pounds per cubic foot, but the classical 100 is still widely used.

Dr. Marston of Iowa State College analyzed the problem and his theory is widely known and accepted. However, application of the theory has not been rapid. Briefly, he made it plain that the load on a culvert could be either more or less than the weight of the overfill prism, according to the relative settlement of this prism and the adjoining fill.

VISUALIZING THEORY

One way of visualizing the theory is by considering vertical shear along vertical planes on each side of the culvert. If the overfill prism has settled more than the side fill, this shear is holding up part of the weight of the overfill prism, and vice versa. Marston related this shear to the location of a horizontal plane where this shear is zero; this is his plane of equal settlement. Its location is related to rigidity of culvert, elasticity of subgrade and compaction of sidefill and overfill.

Another way of visualizing it is to conceive of lines of zero vertical shear in the longitudinal section of the embankment. If the culvert settles with the embankment, these lines will be vertical. If the culvert settles more than the embankment, these lines will converge upward and join, perhaps in the shape of a bothic arch. In that case the load on the culvert is no more than the weight of earth under the vault, no matter how deep the overfill. On the contrary, if the culvert settles less than the embankment, the lines of zero vertical shear diverge upward, and the culvert may have to support an enormous load.

STANDARD BOX CULVERTS

For standardization of box culverts, we have proportioned designs for the classical conception of the culvert supporting the overfill prism—that is, with vertical lines of zero shear. Then we have rated each design for the other two conceptions—converging and diverging lines of zero shear.

This is an application to box culverts of a principle used for concrete pipes for many years. For pipes of standard strength, the allowable overfill depends upon whether the bedding is *ordinary* or *first-class* or *cradled*. For box culverts it is just as logical to limit the overfill according to whether the subgrade is yielding or unyielding, and according to whether there is firm natural soil or backfill alongside the box to share the load.

For low fills, it is evident that the convergence or divergence of lines of zero shear will not have much effect on the culvert load. Therefore, it will not be economy to require expensive improvement of culvert subgrade. As fills get higher and higher, it will be more important to improve bedding and backfill at some expense.

HIGH OVERFILLS

The objective, for high overfills, will be to assure greater settlement of culvert than of sidefill. Modern compaction technique assures good sidefill support, but the thought of yielding

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RESOLUTION No. 4

ADJUSTMENT WITH VARIOUS FEDERAL AGENCIES ENGAGED IN FLOOD CONTROL, NAVIGATION AND OTHER ACTIVITIES

WHEREAS, Many federal agencies have been authorized by Congress to engage in activities to develop natural resources of this Nation and in the orderly development of these natural resources it becomes necessary to construct works for navigation, flood control, power, irrigation and other projects; and

WHEREAS, Such construction often involves the relocation, adjustment, utilization or reconstruction of state highways; and

WHEREAS, There appear to be existing laws, regulations or policies pertaining to the responsibility for these highway adjustments that in the opinion of the members of this Association are not equitable and fair to the states; therefore, be it

RESOLVED, By the American Association of State Highway Officials in convention assembled this twentieth day of December, 1946, that this association appoint a committee to confer with representatives of these federal agencies to work out an equitable solution of these problems and to determine what amendatory legislation or policies are required to correct this situation; be it further

RESOLVED, That copies of this resolution be delivered to the Department of Interior, the Department of Agriculture, the War Department and such other federal agencies as are or may be involved.



Newly elected officers of AASHO, left to right—R. H. Leavitt, Utah, Executive Committee; Clarence B. Shain, Washington, Regional Vice President; C. H. Sells, New York, Executive Committee; R. H. Baldock, Oregon, First Vice President; C. W. Phillips, Tennessee, President; G. H. Henderson, Rhode Island, Treasurer; Spencer Miller, New Jersey, Regional Vice President; and W. W. Polk, Illinois, Regional Vice President; F. Elgin Bayless, Florida, Regional Vice President, and F. R. White, Iowa, Executive Committee, are not in this group.

Relation of The Petroleum Industry To All State Highway Gas Tax Programs

Speaking in his capacity as President of the American Association of State Highway Officials, M. J. Hoffmann, Minnesota State Highway Commissioner, delivered the following address at the annual convention of the American Petroleum Institute in Chicago on November 12, 1946. A good part of it dealt with the very pertinent and potent subject of gasoline tax, its relation to the highway program, and the respective interests of the two groups thereon. Mr. Hoffmann's address was a rather straight-forward discussion of this important matter and one which California Highways and Public Works believes is worthy of widespread publication.

AT THE outset I want to congratulate the members of your group, and the industry you represent, upon the excellent job of reconversion which you have done. When gasoline rationing was ended immediately following V-J Day, you were prepared to meet the increased demand for your products and you have continued to do so without interruption by strikes or shortages and with only a relatively moderate increase in retail prices.

The steady flow of motor fuel has been of particular interest to the members of the organization I represent, since the taxes you collect from the road user group supply a large part of the nation's highway funds. If the industries which furnish our road and bridge materials and equipment had been as fortunate in reconversion as you have been, the postwar highway improvement program would indeed be much farther advanced than it actually is.

It is hardly necessary to point out the mutual interest in highways between the petroleum industry and the highway administrators group. While it may be said that the gasoline tax is not a tax on the petroleum industry as such, but a tax on the road user which your industry collects for the state and federal governments, admittedly there is a direct relation between this tax and your business. If the tax is unreasonably high, it will affect your business adversly.

MORE TRAFFIC; MORE GAS SALES

On the other hand, if the tax is reasonable, and if it is properly expended for improving highway facilities, this will mean more traffic, more demand for gasoline, and in turn more revenue for more good roads to serve the public. In view of this interdependence, it is unfortunate that from time to time in various states, opinionated differences over highway tax problems have developed to such an extent as to jeopardize the friendly relations that should exist between your industry and the officials administering our highway system.

Such controversial differences regrettably breed ill feeling. They contribute nothing toward a sound solution of the issues confronting us, in that they obscure the large and important areas in which highway officials and the petroleum industry share common interests and objectives.

I speak plainly on the point because I believe the best way to overcome difficulties of this kind is to get together and make a sincere effort to reconcile our differences. Frank and friendly discussion of any problem usually has a way of dissipating mistrust and misunderstanding, and of promoting greater mutual respect and cooperation.

BETTER UNDERSTANDING

The Chairman of your Highway Policy Committee, Mr. L. S. Wescoat, I am sure shares the same viewpoint. His forthright and sincere remarks at the last annual meeting of our Association in Oklahoma City did much to open the way to an interchange of views and I hope a better understand-

(Continued on page 29)

Ladies of AASHO Are Kept Busy

FROM the time they arrived in Los Angeles until the closing hours of the thirty-second annual meeting of the American Association of State Highway Officials, the ladies who accompanied delegates were kept busy attending entertainment functions arranged for them by the Women's Committee, headed by Clare P. Balfour, and Harold P. Norton, Chairman of the Entertainment Committee, under the direction of Convention Manager Frank C. Balfour.



Clare Balfour

Upon their arrival the visiting ladies were met by Mrs. Charles H. Purcell, Chairman, and Mrs. George T. McCoy, Vice Chairman, of the Women's Reception Committee, and the ladies of the Department of Public Works, Division of Highways, who composed the reception committee.

On Tuesday, December 17th, the ladies were tendered a luncheon at the Los Angeles Athletic Club. On Wednesday, they were taken on a sightseeing tour of Hollywood, including a ride through the Paramount Studios, Beverly Hills, Brentwood, Holmby Hills, Bell-Air, and to Santa Monica, returning by way of Wilshire Boulevard to the Beverly Wilshire Hotel for luncheon and a style show presented through the courtesy of the Downtown Business Men's Association of Los Angeles. Following the style show the group visited famous department stores on Wilshire Boulevard. Many of them attended radio broadcasts in Radio City Wednesday night.

Those who wanted to enjoy in full the program arranged for Thursday had to rise early in order to attend Tom Breneman's "Breakfast in Hollywood" as the guests of Raymond P. Day, Western Field Editor, *Contractors and Engineers Monthly*, and the California Ladies. Following the breakfast, the ladies were driven through Pasadena to the Huntington Library and Art Gallery and returned to the Biltmore Hotel headquarters by way of the San Gabriel Mission.

In addition to the special entertainment provided for them, the ladies of the AASHO were also guests at the dinner at the Earl Carroll Theatre Restaurant in Hollywood, the Banquet in the Biltmore Bowl on Thursday night and the sight-seeing trip which concluded convention activities on Friday.

Honored by AASHO

THE TWENTY-FIVE Year Award of Merit was bestowed upon the following 12 officials of the California Division of Highways by the American Association of State Highway Officials. The award is for 25 years or more outstanding service in highway work.



Retiring President Hoffmann presents gavel to his successor, President Phillips, left

	Years
C. H. Purcell, Director of Public Works	33
G. T. McCoy, State Highway Engineer	29
R. M. Gillis, Construction Engineer	31
Richard H. Wilson, Office Engineer	31
Charles H. Whitmore, District Highway Engineer, Marysville	29
George F. Hellesoe, District Highway Engineer, Eureka	28
S. W. Lowden, Acting District Highway Engineer, Bishop	34
F. W. Panhorst, Bridge Engineer	25
H. B. LaForge, Engineer, Federal Secondary Roads	27
Fred J. Grumm, Assistant State Highway Engineer	25
L. V. Campbell, Engineer of City and Cooperative Projects	28
R. E. Pierce, Headquarters Office, Sacramento	31



This is the group largely responsible for the success of the 32d annual meeting of the American Association of State Highway Officials. Left to right—Asthore Clark; Frank C. Balfour, Convention Manager; Lucile Carleton; State Highway Engineer George T. McCoy, General Chairman; Marion Farrant; Harold P. Norton, Chairman, Entertainment Committee; Clare P. Balfour, General Chairman, Women's Committee; and Dorothy Williams. Larry P. Friel, Chairman of the Housing Committee, is missing from this picture.

Retiring President of AASHO Reviews Problems and Hopes of Highway Builders

President's Address, American Association of State Highway Officials, Los Angeles, California, December 17, 1946. By M. J. Hoffmann, Commissioner of Highways of Minnesota.

THIS thirty-second convention of the AASHO marks a return to prewar custom. It has long been our practice in annual assembly to visit states in all sections of the country—north, south, east, and west. Through this means our members have had invaluable opportunity to observe firsthand, methods used and progress made in various localities in highway administration, construction and maintenance.



M. J. Hoffmann

Today we are indeed fortunate that present-day travel conditions have permitted us to assemble once again in the great State of California. Outstanding accomplishments by our host state during the year in legislative fact-finding studies, in highway planning, and in expediting a vast construction program, have indeed aroused our keen interest. They will, I am sure, afford us extracurricular opportunities over and beyond those to be derived from the convention proper.

At our last annual meeting we looked forward expectantly. Economic conversion was already in the making. We hopefully envisioned the early possibility of meeting urgent highway needs with an expanded postwar program. A mounting resurge in highway traffic found the states prepared to meet the challenge with adequate funds and road plans. Certainly public demands for highway improvements were not lacking—what with all the information that had been broadcast concerning the readiness of the states to embark on vast construction programs.

However, major disruptions in basic industries suddenly demoralized reconversion efforts. We recall now all too well the crucial situation which developed immediately following the close of our convention. Labor-management differences on a nation-wide basis at once blacked-out all possibility of early highway construction on an unprecedented scale. Yet in spite of the obstacles, the states generally proceeded to launch their postwar construction programs. From January 1 to November 30, 1946, contracts have been awarded for a total of approximately $479,000,000 for projects involving federal funds, or federal and state funds on a 50-50 basis. This amount of work constitutes a good start, but from the standpoint of highway needs, it admittedly is only a start towards rehabilitation of our Highway System.

Not many states since the end of the war have been so fortunate in awarding construction contracts as has been the State of California. Throughout the country local circumstances together with conditions affecting manpower, equipment, materials and right-of-way have varied greatly. As a result construction figures disclose a wide variation in the amount of highway work placed under contract in the individual states.

A DIFFICULT PROBLEM

Highway officials, faced with increasing construction costs did not find it possible to use the same standards nationally in determining at what level of increase they were justified in awarding contracts or rejecting bids. They truly have been confronted with a difficult problem. Officials, faced with demands for urgent improvements, felt that they would be subject to criticism if they failed to make a start in meeting those needs. On the other hand, they felt that if they proceeded to award contracts at prices that might be construed as excessive, they would likewise be subject to criticism. Some felt too in certain localities that if highway construction contracts absorbed large quantities of manpower, materials and equipment such a development would lend strength to the belief held in some quarters that highway construction was interfering with the urgent housing program.

Highway officials in general appear to have followed a middle course. In conformity to restrictive conditions they have made a sincere effort to carry on justifiable road improvements. As circumstances necessitated they have altered their programs from time to

RESOLUTION No. 5

"ACTION PROGRAM" OF PRESIDENT'S SAFETY CONFERENCE

WHEREAS, This association and its members are unreservedly pledged to support all sound measures for greater street and highway safety; and

WHEREAS, A balanced "Action Program" to this end was formulated and adopted in May, 1946, by the President's Highway Safety Conference, in which the association and its members participated; and

WHEREAS, The "Action Program" recommends cooperative effort, on a nation-wide basis, to secure maximum coordination of highway safety activities, and provides for the establishment of voluntary national committees for this purpose. One of these is a National Committee of State Associations; and

WHEREAS, The program recognizes that major responsibility for meeting the problem rests with the states and communities, and calls for organized state and local effort, with public cooperation and support mobilized through state and municipal conferences and other appropriate activities; and

WHEREAS, Encouraging progress has been achieved in many of the states since the President's conference was held in getting adoption, where needed, of the various measures for highway safety recommended in the "Action Program." Preliminary steps also have been completed for establishing the National Committee of State Associations; now, therefore, be it

RESOLVED, That the members of the American Association of State Highway Officials, assembled in annual convention in Los Angeles, California, December 17-20, 1946, do hereby endorse and support the objectives for highway safety as approved in the "Action Program"; and be it further

RESOLVED, That the association and its members further pledge their support and cooperation in making effective the work of the voluntary nation-wide committees established to promote this program.



Business session of AASHO with many of delegations in seats

time—eliminating or deferring such work as could not be completed due to shortages or other circumstances, and advancing those types of projects on which no serious handicaps existed. As a result the 1946 program reckoned in dollars is approximately at the prewar level.

In the light of urgent needs, highway administrators cannot agree with those who even yet would curtail all public works during periods of "prosperity" and hold such programs in abeyance until there is clamor for governmental efforts to relieve unemployment.

NO CONFLICT WITH HOUSING

There are also other well-intentioned people who would curtail all types of construction except home building, until the present housing shortage is relieved. Obviously housing needs still rate as priority job number one in the construction industry. It is rather difficult, however, to see how highway construction can interfere seriously with home building. The two activities are in different fields entirely. Actually very little road construction equipment can be used advantageously in building homes. Certainly personnel experienced in highway construction cannot be converted readily into carpenters, bricklayers, plumbers and painters. Very significantly, the Federal Works Agency after a most careful investigation found that road construction requires only a negligible amount of critical building materials. The agency further declared that such limited use would not interfere with the housing program.

A basic advantage in continuing highway construction in spite of handicaps is the need for maintaining and increasing such skilled construction organizations as are now available. Contractors, organizations, crews and equipment should so far as possible be kept increasingly busy, but no attempt should be made to unduly push construction work of any type or in any locality so fast that costs will jump to unjustifiable levels.

It is especially important that highway officials keep the public informed of the task confronting them in their endeavors to satisfy the demands of the local communities and the road user groups. It is well to enlighten them on the effects which changing economic conditions have on highway programs. After all, a great deal has been said in recent years about the vast volume of work contemplated under the postwar highway program. With the reduced purchasing value of the dollar obviously fewer improvements are going to be made with the use of available funds than the public might be expecting.

The federal funds already apportioned for the first two fiscal years after the war total approximately one billion dollars. It now appears that by the end of 1946 with but six months of the second fiscal year remaining, only about one-third of available federal aid funds will be committed to approved projects. Obviously many states will not be able to absorb all of the authorized federal aid allotments within the limits of time prescribed by law. The loss of any such aid would work an injustice on those states which, for good reason, have been unable to expedite construction work as rapidly as some of the other states. It is most desirable in preserving present equities that

Congress be asked to extend the time limits during which allotments under the Federal Aid Highway Act of 1944 may be expended.

The matter of future federal aid funds must receive most careful consideration. Slowness in the expenditure of funds provided under the 1944 Highway Act might reasonably justify delay on the part of the new Congress in authorizing additional federal aid funds. Regardless of this possibility we might well, in anticipation of congressional hearings in the relatively near future, heed the warnings now being sounded by various groups.

Significant legislative proposals already are being suggested, such, for instance, as a drastic reduction in all federal expenditures—the early repeal of the federal gas tax and other automotive excise levies—limiting use of federal aid funds exclusively to the National System of Interstate Highways and a limited mileage of other main highways—curtailment of federal aid for use on secondary roads. All these proposals derive support from strongly organized groups. We must not minimize the impact of any such proposals on future highway legislation.

Congressional reorganization of committees if followed presumably will lead to changed procedures. Highway legislation will be routed through new channels, with public hearings being conducted by subcommittees instead of by major committees as heretofore. The responsibility for consideration of authorizations for all kinds of public works by one major committee will likely lead to a substantial change in the methods of evaluating highway needs.

UNCLE SAM NOT SANTA CLAUS

Personally, I am not one of those who expects Uncle Sam to double as Santa Claus every time the states feel the need for additional highway funds. In final analysis, the road users must furnish the greater portion of our highway revenues, whether they are channeled through federal, state or local treasuries. I am of the belief, however, that substantial and continuing federal aid allotments will be needed and in fact are essential to the integration of our various state road improvements into one national highway system.

I am aware that this association on past occasion has by resolution duly made, requested the Federal Government to withdraw from the field of gasoline taxation, leaving this source of revenue exclusively to the states. Far be it from me to question the propriety of the resolution under the conditions existing at that time. But we must admit that circumstances have changed. Certainly under conditions existing today we might well and carefully consider the possible effects of such a policy on future federal aid financing. Revenues must be derived from some source whenever federal aid is authorized by Congress. It seems to me, both proper and justifiable that the Federal Government might well continue to levy road user taxes to an extent sufficient to offset the amounts appropriated for highway aid purposes. The elimination of all federal levies on road users, in my opinion, would be a serious mistake. It could have but one effect—the jeopardizing of future federal highway aid.

RESOLUTION No. 6

PUBLIC LAND HIGHWAY FUNDS

WHEREAS, The Congress of the United States, in recognition of the great burden resting on states having large areas of federal public lands from which they receive no revenue in financing the improvement of highways across such lands, has authorized and appropriated special public lands highway funds to assist the Public Lands States; and

WHEREAS, These appropriations have made possible the expediting of the improvement of links in the Federal Aid Highway System and other main roads across such lands; and

WHEREAS, There are still numerous gaps requiring further improvement which cannot be reached for many years with available State and local funds; and

WHEREAS, There is an unappropriated balance in the existing authorization for Public Lands Highways of $3,000,000 which could be used to great advantage in furthering this needed work; therefore, be it

RESOLVED, That the American Association of State Highway Officials respectfully urges the Eighteenth Congress of the United States to provide for the prompt appropriation of this balance which has been authorized for public lands highways.

OUTSTANDING LEGISLATION

You perhaps recall that the 1944 Federal Aid Highway Bill was enacted only after long drawn-out and exhaustive hearings by the Congressional Highway Committee. Various and diverse ideas were presented by representatives of the various states and others, due largely to the different conditions prevailing in their respective localities. Some of the proposals developed much controversy. The committee carefully gave full consideration to all suggestions.

The act as finally passed is recognized as an outstanding measure in highway legislation. It embraces basic provisions for the Nation's highway needs. Properly, it affords the states considerable latitude to meet the varying conditions. I, for one, believe that the 1944 highway act might well continue for some time as the basic law in general conformity to which future federal aid allotments might be authorized.

In the light of difficulties incidental to the enactment of any highway legislation we might well give serious consideration to this proposal. A reopening on the part of the states, of the controversial questions which developed in the enactment of the 1944 highway act would unquestionably add confusion to a situation which at best is fraught with many difficulties.

Association activities during the past year have involved events and actions worthy of mention on this occasion as a part of my report of stewardship. Permit me briefly to review and comment on some of these matters.

IMPORTANT PROBLEMS

There are many important problems in which we as highway administrators share a common interest with other organizations concerned with various phases of highway improvement, travel and transport. Generally there has been good cooperation and friendly relations with these groups, but occasionally misunderstanding and controversies do develop. This is understandable, since each group must necessarily approach the general problem from a different viewpoint. During the past year your officers and members of the various committees have from time to time met with representatives of other groups or agencies to discuss our mutual problems. While it is not always possible to reach full agreement on all points, it has once again been found that the way to achieve mutual respect and confidence is to subject controversial issues to frank and friendly discussion. I believe that the various joint meetings during the year have opened the way to better understanding and cooperation. I trust that such efforts will be continued.

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Highway Safety Finally Comes Down to Matter of Individual Responsibility

By MAJOR GENERAL PHILIP B. FLEMING

Major General Philip B. Fleming, Administrator, Federal Works Agency, who was scheduled to be one of the principal speakers at the meeting of the American Association of State Highway Officials, was detained in Washington, D. C., and his prepared address was read by D. C. Greer, State Highway Engineer of Texas, a member of the executive committee, AASHO. Following are some excerpts from General Fleming's address:

HIGHWAY safety finally comes down to a matter of individual responsibility. This does not mean, however, that there is not also a collective responsibility to see that the motorist is held strictly accountable for the consequences of his actions. It is a collective responsibility—the responsibility of government, if you please—to see that as much safety is built into our streets and highways as possible; to draw up simple, uniform and understandable rules of the road; to provide clear and unambiguous warning and directional signs, and to proceed with the work of education for the purpose of indoctrinating every motorist and every pedestrian with the safety concept to a point where he will accept his personal responsibility.

The Action Program adopted by the President's Safety Conference covers these three principal points of our collective responsibility which, briefly, are Education, Engineering and Enforcement. There is no magic formula in the program, no simple trick by which traffic accidents can be prevented. The techniques for achieving traffic safety are not new, by any means. They have been tried and found effective; the job is to intensify their use in every city and town and on every highway in America. Too often in the past they have been used only sporadically, and it is now perfectly obvious that brief 'spasm' campaigns produce no lasting benefits.

That rule is best which enforces itself, or which, because it is so logical and so much in accordance with common sense, brings about conformity instinctively.

APPALLING TRAFFIC TOLL

The President summoned his Highway Safety Conference because of the appalling increase in traffic fatalities that followed the abolition of gasoline rationing. At first some thought was given to calling the conference immediately, but it seemed wiser to postpone it until about the beginning of the 1946 touring season, when it was thought the attendant publicity might be more effective in saving lives. Also, it seemed desirable to allow sufficient time to complete a preliminary organization, to afford time for the various committees on different aspects of the traffic problem to complete their studies, and also to enlist the widest possible support. Accordingly, the conference was held early in May.

A year ago it seemed likely that the death toll in street and highway accidents within 12 months would exceed that of 1941, which was the peak year in traffic fatalities. Fortunately we shall fall far short this year of piling up another ghastly record. I hope it is not merely a coincidence that in May, the month in which the conference was held, fatalities turned sharply downward, and the improvement generally has continued since then. More people will be killed this year than in 1945, when, for more than half of the year, gasoline was rationed, but considerably fewer than in 1941.

SOBERING STATISTICS

In the first 10 months of 1946, 27,520 persons were killed in traffic accidents. If such deaths have continued at the same rate during the last two months—for which final reports are not yet available—we shall end the year with a traffic death list of about 34,000. That prospect is sobering enough, but it still represents 4,000 fewer deaths than in 1941.

There was an absolute increase over last year, but a relative decrease. And even in comparison with 1941 our experience this year is much better than the figures alone indicate. The population has increased since 1941 so that the deaths per hundred thousand of population are now much less. Another logical comparison between 1946 and any former year is one based on the number of fatalities per mile driven. During the first eight months of this year fatalities per million motor vehicle miles were 10.2. In August the number of deaths per million vehicle miles was just slightly over seven, the low for recent years. After we have taken such consolation as is possible from such comparisons, we still have to face the fact that traffic fatalities still represent our greatest national disgrace, and must be dealt with. And I think we are almost unanimously agreed that it can best be dealt with along the lines laid down in the President's Conference Action Program.

MUST BE COOPERATIVE EFFORT

That program, as already noted, must be applied locally. The problem cannot be solved from Washington; it cannot be solved by fine words written on paper. The program must be taken to heart and applied by the governors of the states, by our state highway officials, motor vehicle administrators, by the mayors and police chiefs of our cities. It was for that reason that the conference recommended that the governors call state conferences paralleling the President's Conference. The governors have responded very generously, and I believe that about half the states and a number of cities have now held such conferences and others are projected. I have attended some of these city and state conferences and, frankly, I have been surprised at the large attendances and at the enthusiasm displayed. Literally, thousands of citizens in all walks of life are indicating a willingness—even an eagerness—to sacrifice their time and means in the work of promot-

ing highway safety without thought of compensation.

This work must be continued and I feel confident it will be continued, provided only that leadership is forthcoming. And I believe it will be, for we have even arranged for that, too. Among the recommendations which the conference instructed me, as general chairman, to convey to the President, was that steps be taken to coordinate all efforts in the safety field through the organization of three outstanding committees. The first of these was to be a National Committee of Non-Official Organizations interested in the safety field. That committee already has been organized, is at work, and ready to cooperate. It was suggested that the President appoint a Federal Committee on Highway Safety on which would serve representatives of the various government agencies interested in motor vehicle transportation —including the Interstate Commerce Commission, the War and Navy Departments, the Post Office Department, the Department of Agriculture, the Bureau of Standards, the Department of Interior and others. That committee was organized under my chairmanship on October 29th and is at work. We are now compiling a manuel on automobile operation and maintenance, and it also will be our purpose to promote wholehearted cooperation for safety with the appropriate state and local officials wherever throughout the country motor vehicles are used in government business.

NATIONAL COMMITTEE

The third committee suggested was to be a National Committee of State Officials. What is visualized here is an organization embracing the American Association of State Highway Officials, the American Association of Motor Vehicle Administrators, the International Association of Chiefs of Police, the National Association of Railroad and Utility Commissions, the National Council of Chief State School Officials, the Association of State and Territorial Health Officers and the Council of State Governments.

A preliminary meeting of representatives of some of these organizations was held at Washington in my office on October 30th. They were sympathetic toward the objectives sought, but generally they felt they could not commit their organizations to membership without specific instructions from their governing officials. It will take some time, of course, to inform the members of the various organizations of what is intended and obtain their consent to participation. But I have no doubt that consent will be forthcoming and that it may be possible to complete the organization of the State Committee early in the new year.

STATE FUNCTIONS

In some respects I think the state committee can be more useful than either of the others. Traffic regulation and control, the licensing of drivers, the inspection of motor vehicles are state functions, and I think we all want them to remain state functions. I don't think any of us want to see Uncle Sam stalking over the Country in the role of a traffic cop. There has been a good deal of complaint that the Federal Government already has usurped too many state functions and prerogatives. However, I think that much of that has come about because of unwillingness of the states themselves to act. Overlapping of authority among state departments, each concerned with some aspect of the traffic problem, must be avoided. Also, lack of uniformity in licensing regulations is notorious. Such regulations range all the way from the unnecessarily rigid to the unbelievably lax. In one state the penalty for driving without a license may be as light as a reprimand or a five-dollar fine, while in the next state it may be a thousand dollar fine and a year in jail. It seems at times as though traffic regulations were as diverse among the states as devilish human ingenuity could make them.

Addressing his Highway Conference, the President pointed out that in his own state of Missouri anyone could buy a driver's license at the corner drug store for 25 cents. He denounced the laxity of regulations in many of the states which, to use his own expression, turn any "nut" or "moron" loose on the highways to maim and kill. When a member of the Senate, the President three times introduced legislation which would have established certain minimum standards for the licensing of drivers crossing state lines. Twice the Senate approved such legislation but each time it died in the House. I think stringent federal legislation in the safety field is almost certain to come unless the states themselves soon take appropriate action.

The legislatures of most of the states will be in session again this winter. Certainly it is not too early for those state officials who have any responsibility whatever in matters of highway traffic and highway safety to begin laying the groundwork for appropriate legislative action. The situation is fatally serious, and we dare procrastinate no longer.

Shanghai May Be Far Ahead of Us

SHANGHAI, China, may be a jump ahead of the Action Program adopted by the President's Highway Safety Conference in attacking the problem of traffic fatalities. Major General Philip B. Fleming, Administrator, Federal Works Agency, injected this humorous possibility in his address which was read before the meeting of the American Association of State Highway Officials.

In discussing the action program, General Fleming said he had recently received a newspaper clipping setting forth what he assumed might be the action program of an organization known as the Shanghai Health Precautionary Association. The clipping follows:

"All motor cars have rubber tired wheels and run without noise. It is too late to blow a horn when a car has already collided with a pedestrian. A car should have a very small bell attached to one of the front wheels and this bell should be kept ringing all the time so that when pedestrians hear it they can get out of the way.

"There should be one licensed chauffeur and an assistant to take care of each motor car. The assistant should sit behind and keep a lookout when the car turns around, goes backward, enters or leaves the garage. The owner of the car will not mind spending a little money in employing an assistant chauffeur.

"After a person is killed by a motor car a wax image of the decedent should be made and placed in a room. Any chauffeur who causes injuries to others should be locked up in the room so he will see the image and feel sorry. This may cause him to repent. This has been introduced in America and has produced successful results."

Radio Communication System Demonstrated by California Division of Highways

AS A special feature of an exhibit prepared by the California Division of Highways for the annual meeting of the American Association of State Highway Officials there was a demonstration of two-way radio communication as used by the Division.



T. H. Dennis

For this purpose two radio stations were installed in the Biltmore Hotel, one system demonstrating the use of FM radio (frequency modulation or very high frequency) the other the use of medium wave or the type commonly used by commercial radio stations.

From the exhibit room in Los Angeles radio contact was maintained with permanently located land stations owned and operated by the Division of Highways stations in the San Bernardino-Lake Arrowhead area.

The State of California is one of the few states operating a radio communication system owned and operated by the Highway Department.

There are presently 75 land and mobile stations throughout California and there are now plans for immediately expanding the system.

This radio system is used for a variety of purposes but its principal use is in emergencies arising during the winter season as regards snow removal on state highways. Snow plows in the San Bernardino Mountains in Southern California and the Sierra Nevada Mountains in Northern California are equipped with two-way radios enabling them to maintain contact with land stations located at their base station.

In addition two-way radio has been installed in superintendents' and foremen's cars responsible for maintenance of their respective sections of state highways. This enables them to expedite men and equipment in emergencies arising from storms, slides, slip-outs and any emergency arising which requires immediate attention. Such a system is also to be installed within a short period on the San Francisco-Oakland Bay Bridge to expedite the removal of stalled cars and wrecks and for fires.



Scene in radio communications exhibit room of California Division of Highways

The Committee on Use of Radio in Highway Departments, which is headed by T. H. Dennis, Maintenance Engineer of the California Division of Highways, conducted an all-day session on Thursday, December 19. Many of the states were represented and there was much interest manifested in the demonstration of the use of radio equipment. Henry A. Radzikowski, Chief of the Division of Maintenance of the Public Roads Administration, Washington, D. C., acted as secretary.

It was pointed out by Frank B. Durkee, Attorney for the California Department of Public Works, that if the states wish to protect their rights under the Federal Statutes administered by the Federal Communications Commission, it is urgent that they work together to show that public convenience and necessity require definite allocation of classifications of wave lengths by the Federal Commission. This proposal was supported by the convention.

More than 450 delegates visited the radio exhibition room and witnessed demonstrations of California's use of radio in highway work.

RESOLUTION No. 8

USE OF RADIO BY HIGHWAY DEPARTMENTS

WHEREAS, The railroads and users of highways, such as power, gas, transit utilities, bus, truck and other road services, have been removed by the Federal Communications Commission from the special emergency classification for the use of two-way radio telephone and given a broader defined permissible use of radio for their operations; now, therefore, be it

RESOLVED, That the highway departments, agencies of state and local governments, with the duties to build, maintain and operate highways for the safe use of traffic and the public welfare be given similar treatment by the Federal Communications Commission.

Highway Improvement Program in Relation To the Conventional Public Works Concept

(Paper presented by Thos. H. MacDonald, Commissioner, United States Public Roads Administration, at the Thirty-second Annual Meeting of the American Association of State Highway Officials.)

TRADITIONALLY, the popular concept of public works embraces highway improvements. This, in itself, might result in no adverse consequences were it followed by a breakdown of all public works into the deferable and the nondeferable groups, predicated upon the degree of essentiality of the service which each one provides or the purpose which each one serves. There has been, as yet, no accepted distinction. It is common to include all works directed and paid for by the government in a single category, subject to the same policies.

In a period covering little more than a decade, the Nation has lived through two experiences reflecting the extremes in public works undertakings. The first of these was the result of the desperate efforts to supply employment during the depression years. Public works of many types were undertaken on a maximum scale virtually unlimited by the finances required. The second period was coincident with the war years when public works were severely limited to those serving the war effort. These two extremes in our recent national experience had this in common. The realized and product was determined by the human and material resources that could be, and were, made available. These resources reduce principally to the elements of labor, management, equipment, and materials.

ELEMENTS THAT CONTROL

Now we are in a third period, as yet more limited in time, but the postwar months have evidenced control of production by the same influence of available resources. While we worry about costs and the finances to meet them, it is evident that basically our ability to carry on a highway program rests on other factors. Since we started the postwar program, the criterion of contract awards has been the price index, but this is only a composite reflection of the meager availability of resources relative to the overall demands. While the contributing causes may be different, the current status of the program follows rather closely the pattern set in the months immediately following World War I. The federal aid projects put under way since the bars were taken down approximate 40 percent of our estimate of the program that would have matured with the funds available under normal postwar conditions. As it is, the progress compares favorably with the level reached in other fields. The evidence indicates that any further extension would not have been justified since 28 percent of the projects are lagging, due to deficiencies in one or more of the necessary elements. In general, additional awards would only have increased this percentage of lag.

With the close of the war, housing was rightfully accorded priority, and the highway officials have been faced with no criticism resulting from interference with the housing program. On the contrary, much assistance has been rendered this program by the extension of access roads to facilitate the production of building material, such as lumber. An even more important aspect of the interrelationship of housing and highways will be suggested later.

RESPONSIBILITY OF HIGHWAY OFFICIALS

We are, as yet, a long way from being out of the woods, and in the many years of cooperative effort between the state highway departments and public roads there has never been a time when mutual helpfulness and tolerance were needed as they are now. This responsibility extends beyond the highway officials to include the major elements of highway users and industries which are the chief beneficiaries of a sound program of highway improvement. As public officials responsible for highway administration, it is our duty to inform the public at large, and more particularly the legislative branches of the State and Federal governments, of the problems currently confronting the integrity of our highway plant. Fortunately, to serve this purpose we have the factual data from the Highway Planning surveys. This attitude of responsibility to the public is a characteristic inherent in qualified public officials under any circumstances, but under the stress of present uncertainties it becomes an essential.

The executive departments of the states and of the Nation are facing difficult policy determinations. This is true also of state legislatures. The Congress has adopted a reorganization plan that places highway work under the jurisdiction of a Public Works Committee, which will, in the future, consider and determine the policies for all works supported by

RESOLUTION No. 7

REVIEW OF POLICIES OF U. S. ARMY ENGINEERS CORPS ON CLEARANCE OF HIGHWAY BRIDGES OVER INLAND WATERWAYS

WHEREAS, Large expenditures of public highway funds are being made by the various states largely in cooperation with federal funds in the construction of highway bridges over inland waterways; and

WHEREAS, The cost of such structures is influenced by rules and regulations prescribed by the Corps of Engineers, United States Army, in fixing clearances both vertical and horizontal, to be met in the design of such structures; and

WHEREAS, Such rules and regulations are not in all cases consistent with the relative importance of waterway and highway traffic to be accommodated, resulting in vehicular traffic being unduly penalized and an unwarranted expenditure of public funds made; now, therefore, be it

RESOLVED, That the Corps of Engineers, reinforced by the report of the Bridge Committee, be requested to review their present policy and at their public hearings on applications for waterway crossings by public highways, that arguments be requested showing relative benefits, both present and future, to be derived by water borne and vehicular traffic and that clearances be determined upon a basis of the relative importance of the class of traffic to be served—consistent with the expenditure required and with the public interest.

federal funds. We can have full faith in the decisions that will be reached, whether these are executive or legislative determinations, if we first agree among ourselves upon a sound program and, second, marshal the convincing and accurate factual data upon which our recommendations rest.



On behalf of delegates, California State Highway Engineer Geo. T. McCoy presents retiring President Hoffmann with gold watch

FALLACY IN THEORETICAL CONCEPT

There is no purpose here to draw comparisons or to argue the relative importance of the various types of public works. This analysis concerns itself solely with highways and is designed to prove why the traditional concept of highway improvements as public works that may be undertaken or may be deferred is fallacious in the extreme. Government has undertaken to supply certain services which cannot be provided as private undertakings with private capital. All such efforts in the past have ended in failure or, at best, inadequate services.

Among such government-supplied services are sewerage, water, roads and streets, public schools, and police and fire protection. These are all an inseparable part of our individual and community lives. They are to a large extent interdependent or complementary. They require certain continuing works of construction and maintenance that cannot be turned off or turned on to accord with some theoretical concept of using such works to fill the gaps if private employment lags. There can be, of course, a reasonable degree of acceleration or deceleration, but a going program must be maintained.

The theoretical concept of such works as intermittent activities presupposes quite falsely that all private works and all private employment transcends in importance the health, the protection, the daily pattern of life of every community, large and small. He who realistically thinks through the daily, even the hourly, dependence of every individual and of every community upon all these services will reject any such conclusion.

The utter dependence upon the roads and streets in the routine of our daily life has been doubly fixed by the advent of the motor vehicle, both passenger and goods carriers. Thus, highway improvements cannot be evaluated as public works. Their services must be measured in terms of saving lives, of preserving property values, of maintaining essential services, and of sustaining major industries. The too prevalent economic concept of holding back highway improvements to bolster employment, if or when unemployment appears, is a completely fallacious theory. It disregards the essential principle that the highway plant, like all physical properties, is constantly deteriorating. This fictitious concept, which has too long been unchallenged, fits well the definition of economic theory that draws "a mathematical precise line from an unwarranted assumption to a foregone conclusion." The only sound approach is to accept the principle that to avoid irreplaceable losses the highway plant must be continuously renewed and replaced.

Adjusted to current values, our highway plant reasonably represents a $30,000,000,000 asset. There are (1945) 1,430,000 miles of surfaced rural highways and 220,000 miles of surfaced urban streets. This mileage provides a virtually continuous network for the movement of traffic, but it is composed of many thousand individual segments from less than one to more than 30 years in age. Basically, our problem is to keep this vast physical structure operating efficiently. It cannot be done without a large scale annual program of replacements and modernization, in addition to routine maintenance. Most fortunately, it is not necessary to beg the question. Down-to-earth research has been a handmaiden to the highway administrator from the early inception of modern highway development. We now do not need to depend on broad generalization. The facts are available.

Just what do our highways mean today? First, consider their relation to the public in general. Total highway use skyrocketed from an estimated 55,000,000,000 vehicle miles in 1921 to 333,000,000,000 in 1941. This later figure represents a travel for each person of our total population of

around 2,400 miles annually. What possible use of the highways and streets could add to this amazing total when considered in terms of this comprehensible figure of the average person's travel? To understand this, it is necessary to review what has happened to the pattern of daily life and the reorganization of our internal economy in every quarter of the United States.

SERVICE TO THE RURAL AREAS

Total traffic is about evenly divided between urban and rural areas. Consider the rural areas first. No attempt is made to recite the whole story. The examples given are only indicative of the magnitude and range of the services the highways must perform for agriculture. There are approximately six million farms producing foods and materials for processing into clothing, building materials, and other products of commerce. In 1945, the production of 28 important farm items aggregated more than 177,000,000 tons, a 37 percent increase over the average for 1936-1940. For the current year, the record is expected to go higher.

SERVICE TO AGRICULTURE

The first movement to market of substantially every ton of agricultural production is over the highways. Important percentages of these food products continue direct to the market and to the individual consumers. For example, 62 percent of the butter for the Chicago market is received over the highways; so is 85 percent of the fresh fruits and vegetables for the City of Los Angeles, and 96 percent of the live poultry for San Francisco. In 1944, when meat was so vitally necessary, more than 52,000,000 head of livestock, which was 59 percent of the total receipts, came by the highways to 17 of our larger stockyards.

One needs to experience the scant supply and inferior grade of milk in other countries to appreciate what a luxury our dairy farms supply in copious quantity and at relatively low prices for us. In England, at present, or in India continuously, milk of good quality is simply not available for general use. How often do we pause to consider how many of the essential foods are made possible only through highway transport? When we have eggs for breakfast here in Los Angeles, as road builders we can claim a reasonable share in their availability since 93 percent of the supply comes over the roads.

Rural education has rapidly embraced the school bus without much fanfare and without much recognition that it is the magic wand that has transformed the one-room district school to the graded consolidated school, which also frequently serves as the community center. When such a predominantly agricultural state as Iowa has a motor vehicle for each 3.5 persons, this figure of 2,400 miles of road travel per year per person begins to appear reasonable.

But this is only the first half of the story. Until about 1917, the typical urban area was compact. There was

Delegates from Puerto Rico and Hawaii Travel Long Distances To Meeting



Delegates from Puerto Rico and Hawaii get together at 32d annual meeting of the American Association of State Highway Officials. Left to right, Top Row—J. C. Myatt, B. F. Rush, Frank R. Carlson, and T. Y. Awana, Hawaii. Lower—Ernesto Pinero and Jorge V. Toledo, Puerto Rico; C. Nils Tavares, Attorney General, Honolulu

THE GOVERNMENTS of Puerto Rico and Hawaii considered the thirty-second annual meeting of the American Association of State Highway Officials important enough to send delegates thousands of miles to attend.

These delegates attended many committee meetings to learn at first hand how the highway departments of the United States proposed to cope with the many postwar problems involved in highway construction.

From Puerto Rico came Ernesto Pinero, Director of Division of Maintenance, and Jorge V. Toledo, Chief Counsel.

Hawaii sent Frank R. Carlson, District Engineer, Public Roads Administration, Honolulu; B. F. Rush, Superintendent of Public Works, Honolulu; C. Nils Tavares, Attorney General, Honolulu; J. C. Myatt, Highway Engineer, Honolulu; and T. Y. Awana, Chief Cadastral Engineer, Honolulu.

only a moderate finger development into the surrounding areas along the extension of city streetcar lines. An example of what has happened since the general urban use of the motor vehicle is more concretely expressed by the example of the District of Columbia, which has a land area of 61.4 square miles. In 1915, there were only 8,000 motor vehicles; busses had not come into use, and 65 miles of streetcar track served the residents. A few lines of street railway extended through the District into adjacent Maryland. There were about 380,000 people, and excluding the 15 square mile compact area, 50 percent of the remaining, that is, 23.2 square miles, was within one-quarter mile of the streetcar lines. Only 8.4 square miles of the area within this distance had been developed and that rather sparsely. Of the 23.2 square miles of more than one-quarter mile from street cars, 2.8 square miles had been developed.

In 1940, with a population of 663,091, practically the entire useable area has been developed with no appreciable increase in street car mileage. There has been a large extension of public service by bus lines. The suburban area of Washington is considered about 130 square miles, of which about 31 square miles are in Alexandria and Arlington County, Virginia. In 1915, there were 43 square miles within one-quarter mile of suburban street car lines, of which about 7.5 square miles were within one-quarter mile of these lines in Alexandria and Arlington. Some three-quarters of this latter area was developed to some extent, and about two square miles in the Virginia portion of the metropolitan area.

TYPICAL EXAMPLES

Since 1915, the street cars have entirely disappeared from Arlington and Alexandria. The area between the radial routes first built up along the car lines now is largely developed into residential areas served entirely by motor vehicle transportation. At present, there remains only about five square miles undeveloped, some of which is in rough topography along the banks of the Potomac River. Thus, motor-vehicle transportation has increased the developed suburban area of Washington in Virginia from 9.5 square miles in 1915 to approximately 22 square miles at the present time. This development has been the result of filling in between the radial routes without an appreciable extension of the developed area until very recently.

RESOLUTION No. 9

COMPLETION OF PAN-AMERICAN HIGHWAY TO PANAMA

WHEREAS, The Government of the United States was officially responsible for initiating the creation of a Pan-American Highway System and for inaugurating the original reconnaissance surveys of that section thereof between Panama and the United States; and

WHEREAS, The government has from time to time encouraged other countries to undertake both cooperative and independent construction within their respective jurisdictions, furnishing assistance of both a technical and financial character; and

WHEREAS, These activities and official expressions by our government have produced a public and official opinion in most of the interested countries, that the United States Government is committed to assisting so far as may be necessary each of the countries of Central America and Panama in carrying the Inter-American Highway Project to practical completion without serious interruption; therefore, be it

RESOLVED, By the American Association of State Highway Officials in annual convention assembled, that the Eightieth Congress of the United States be urged to recognize as a policy of this government the furthering, as a peacetime project, of the completion of a highway between the United States and the Panama Canal, and to provide from time to time such funds as may be needed, under terms and conditions that the Congress considers practicable, for the uninterrupted prosecution of the Inter-American Highway to Panama.

This is typical of what has been going on in all metropolitan areas. The population of the central cities of 140 metropolitan areas increased by only two and a half million in the decade from 1930 to 1940, while in the same period the urbanized area outside the central cities gained almost 3,000,000. As a percentage, the surburban areas gained at a rate approximately three times as fast as the central area. But in many cities, there was an actual decrease of the population. The central city area of Boston lost 10,000 people, and the suburbs gained 53,000. Cleveland decreased 22,000 in the city proper, and increased 42,000 in its outlying areas. While the population of the city of Detroit was increased 55,000, the metropolitan district increased 136,000.

Some have attributed this changing pattern of our cities to the motor vehicle. This is not true. The motor vehicle made it possible for the people to escape from decadent areas at the hearts of cities, but they did not create the conditions which forced the people to abandon these areas. The motor vehicle offered escape from intolerable conditions which had developed. This abandonment of the central city has created serious problems, of which more will be said later. The very existence of these problems, however, indicates the degree to which urban life has become dependent upon the motor vehicle, which means necessarily the maintenance of the highway plant.

DEPENDENCE OF MAJOR INDUSTRIES UPON HIGHWAYS

These are some of the facts of highway utilization. Just what do they mean to the industries dependent not only upon the maintenance of the existing mileage of all-weather roads and streets but upon its extension? Facing the future, there is one precept upon which there is general agreement. It is repeated over and over by high authority, not only in our own country but in other nations of the world. The one formula urged to defeat economic catastrophe is full production.

In the United States, the highway plant is the principal support of a number of our major industries directly, and of a very considerable number more indirectly. Of these, the petroleum, automotive, and rubber industries are examples. Full production in these industries means nothing and cannot be sustained unless there is an equal consuming market. We are proud of these great industrial empires. Yet, they could not exist without the highway plant. Conversely, neither would we have brought into service the extensive mileage of highways without the pressures created by the public demand to use the products of these same industries. So the two are mutually dependent and common problems need to be considered in this spirit.

THE PETROLEUM INDUSTRY

The dependence of the petroleum industry upon the maintenance and constant expansion of the highway plant to furnish the major market for its products is dramatically shown by the growth in consumption of gasoline from 3.9 billion gallons in 1921 to more than six times as much, estimated at 24 billion gallons in 1941. This astonishing record of expansion of the market of motor fuels runs parallel and, in fact, outpaces the mileage of roads capable of carrying the ever-increasing numbers of cars that the public was eager to use as rapidly as even reasonably suitable facilities upon which to operate them were provided.

The total mileage of all-weather rural roads increased from 387,000 miles in 1921 to 1,385,000 in 1941. The mileage of high-type surfaces increased from 36,000 to 194,000 in the same period. The consumption of motor fuel increased six times, while the all-weather surfaces were increased between three and four times. This is explained by the increase in the use of the individual motor vehicle from about 4,500 miles per year in 1921 to over 9,000 in 1941. That the use of each motor vehicle was doubled reflects primarily the growth of improved highways and streets that imposed less and less restriction on the freedom of movement of the individual owner.

GASOLINE TAXES

Gasoline taxes, federal and state, have increased steadily since the original Oregon law of 1918. A searching examination of the relation between the rate of taxes imposed and the individual state consumption of gas does not disclose the faintest evidence of restriction of the market from this cause. On the contrary, since the income from these taxes has been so large a factor in extending the mileage of improved roads, the conclusion is inescapable that the constantly growing market for motor fuel is a direct result of these taxes.

One of the most remarkable facts reflecting the importance of highway transport and its capacity to sustain the gasoline market is that the growth of the over-all consumption continued through the depression, with the exception of two years, although the sales of new motor vehicles decreased to about 30 percent of the peak year, 1929, of 5,358,420 units. The motor industry at present does not have to worry about markets for its output. As a long-term matter, however, there are two areas which offer the best chance for increased sales, but the potentials of both of these for increase in car ownership are dependent upon the extension of road improvements.

Unincorporated areas, as of 1940, supported only 168 cars per 1,000 population. At the other extreme, cities in the 500,000 and over class had only 183 cars per 1,000 population. For the same year, the average for all areas of the United States was 208 motor vehicles per 1,000 population. In California, there is the startling ownership of 355 vehicles per 1,000 population.

INCREASING MARKET

Assurance of the constantly increasing market for the output of the rubber industry is inherent in the constant upward trend in the mileage each vehicle is operated annually. In addition, one of the very important outlets is the growth in the requirements for heavy duty tires in mammoth sizes, which have become standard in roadbuilding equipment. The fact may be noted that the efficiency of roadbuilding equipment, and even the type of design, have been controlled in a major way by the ability of the rubber industry to produce tires of the capacity and durability which make possible the larger units.

There can be no serious question as to the degree of dependence of the petroleum, the automotive, and the rubber industry for their major markets directly upon the maintenance and extension of the highway plant. Many other industries are directly or indirectly supported by this same plant. If there is any legitimate criticism of the state and federal taxes upon the products of these major highway industries, it must rest upon the diversion, the dissipation, of the failure to collect equitably these taxes and to use the proceeds for highway improvement purposes.

RESOLUTION No. 10

INTER-AMERICAN COOPERATION IN INTER-AMERICAN HIGHWAY PROJECT

WHEREAS, Mexico, the several countries of Central America and Panama, over many years, both by independent action and through cooperation with the United States, have substantially advanced the construction of the Inter-American Highway across their respective territories to such extent that over fifty (50) percent is now paved and over seventy (70) percent is passable in all seasons; now, therefore, be it

RESOLVED, By the American Association of State Highway Officials, in their annual convention assembled, that the association reaffirm its interest in the Inter-American Highway project: extend to the several countries concerned its appreciation of the excellent professional and technical accomplishments of each of them; and assure them of the continuing encouragement and support of the association in the united efforts of their governments and that of the United States in carrying the project to an early and successful completion.

In 1946, the total of all state and federal imposts upon the road user amounted to no more than three-fourths of 1 cent per mile of travel. If the cost of car ownership and operation is no higher than 4 cents per mile, a figure far too low for a fair average, the highway cost would be only 18.75 percent of the operation cost. This is less than the differential between operating cars over worn and rough roadways, as compared with the cost of operation over smooth roadways.

PRESENT TRENDS IN HIGHWAY TRAFFIC

October of this year produced the highest volume of traffic for that month ever recorded for the United States as a whole. In the eleven Western States, the total traffic was more than 31 percent above the October, 1941, counts, and on the main roads in California the increase was 45 per cent over the 1941 volume, which was the previous highest October record. As compared with 1945 volumes, traffic in the Western States is up 23 percent; in the central regions, 25 percent; in the Eastern States, 26 percent, and on California main roads, 30 percent. Traffic in seven representative cities in October of this year showed volumes well in excess of the 1945 volume, varying from an increase of 15 percent in Washington, D. C., to 34 percent in Santa Fe, N. M. This acceleration of highway use induces much foreboding on the part of the highway official confronted as he is with current limitations upon replacements and maintenance of the highway plant.

The highway construction program must continue at as high a level as is consistent with the availability of the component resources. It is certain that most of the required elements are as yet in scarce supply. The line will still have to be held on the basis of prices, which quite accurately reflect the ability of the contracting industry to deliver the finished product. It is apparent that high prices as such will not complete work. It is our responsibility to keep contract prices on a basis fairly comparable with costs.

One of the elements that is seriously lacking in many States is sufficient competent engineers for the highway departments' own organizations. This is a serious drag on production, and the situation will not be remedied until there is a decided upgrading in salaries. There are certain phases of the current situation that should be given special attention.

Housing can be greatly aided by proper planning of highways, particularly in urban areas. It is probable that much emphasis will be placed upon large projects of the multiple-unit type because of the high cost of single dwellings. Such projects may be undertaken as part of the redevelopment of slum areas and the recapture of property values in decadent areas. Seven such projects are now under design or under construction in the City of New York. One of these Stuyvesant Town, financed by the Metropolitan Life Insurance Company, is to have 8,773 apartments. Although the project is located within walking distance of centers of employment, thus reducing transportation requirements, a provision for motor vehicle transport is an essential part of the plan. One corner of the area fronts on an existing expressway, which is to be extended. Garage space for 2,400 cars is to be provided and off-street surface parking is to be available for 300 cars. Frontage roads encircling the development at the edges of the area are to be widened. This would have been impracticable because of cost were it not undertaken as a part of the over-all plan. The interior streets will be closed.

Here in Los Angeles, is an excellent example of the problem of the metropolitan areas. The city has an actual corporate area of 452 square miles, but the urban area spreads over 600 square miles. Within this area, there are 1½ million people and 30 cities of 5,000 or more population. This situation is on an exaggerated scale perhaps, but it is more or less characteristic of the situation confronting all metropolitan areas.

Parking congestion on the streets and lack of off-street parking are gradually throttling the business district and the loss of property values can only be checked by major redevelopment of these necessary traffic fatalities. It is hopeless to attack this problem of city traffic congestion by palliative measures, such as street widening. One well-designed four-lane expressway will accommodate the same number of vehicles at nearly twice the average speed as will five 40-foot ordinary streets on which parking is prohibited and under favorable conditions of traffic control for the intersecting streets. Under unfavorable conditions, it will require eight typical city streets 54 feet wide on which parking is permitted to serve the volume of traffic that may be handled more efficiently on one four-lane expressway. The limited-access highway is the only possible means of coping with urban congestion, so far as moving traffic is concerned. Parking facilities must be made an integral part of the over-all plan. This city problem in the States where it exists is so serious as to demand the full cooperation of State, urban, and federal highway officials.

The serious lag in replacement of federal-aid highways is indicated by the latest in-

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Problems and Hopes of Highway Builders

(Continued from page 18)

Immediately following our last meeting, the states by letter ballot officially adopted the "Recommendations on Highway Loading" as prepared and submitted by the Transport Committee. This action by the association has brought forth numerous expressions of approval by various groups interested in highway transport problems. Even so, certain segments of the truck and bus industries have already requested revisions in the newly adopted recommendations.

TRANSPORT COMMITTEE STUDIES

In view of the thorough and careful study of this subject made by the Transport Committee, and the general approval of that report as given by the association membership, no action looking toward further revision of that policy should be taken without most deliberate consideration. Nevertheless, it cannot be considered a closed subject. It is certain that requests for revisions will be made from time to time, and it is necessary that such requests be carefully scrutinized. It should also be borne in mind that present day design of highway structures has direct bearing on possible future revisions of the policy relative to highway loading. This is particularly significant in the case of bridges on the National System of Interstate Highways and other main heavy traffic routes. This situation may well merit our further consideration.

The revised constitution adopted at our last annual meeting provides for a number of changes in association committees. Reorganization in conformity therewith was authorized by the executive committee at its midyear meeting. To avoid undue interference such committee changes as are necessary will be made immediately following this convention. Whereas in general committee assignments are made on the nomination of the officials of the various states, it is important that such officials extend their full cooperation in making such nominations, in order that the committee changes can be effected with the least possible delay.

An event of significant importance, in which members of the association participated actively, was the President's Highway Safety Conference. Out of that conference came an "action program" for the states and for communities which, if aggressively applied, will aid materially in reducing the unnecessary toll of life and limb resulting from highway traffic accidents. Highway officials in many states are presently giving leadership and support to follow-up conferences and to other activities designed to make our streets and roads safer. The safety problem demands full and active participation by all state highway departments.

ACTION PROGRAM

The "action program" recommended that the activities of the several state agencies having jurisdiction in highway transportation matters be coordinated nationally through a committee representing their respective national organizations. Such a committee has been set up for this purpose, and our association must of necessity extend its cooperation in this work.

The shortage of technical personnel is one of the serious handicaps still confronting the states in their efforts to expedite the postwar program. Graduates from engineering schools who formerly sought state employment in lower grades in the hope of later improving their status, are continuing to enter federal service or private industry at starting salaries much in excess of what highway departments in most states are permitted to pay. The Commissioner of Public Roads at our last convention very emphatically sounded a word of warning regarding the inadequacy of engineers' salaries. A special association committee since appointed to make a comprehensive study of the problem will submit its report at this meeting. I trust the states will find this report to be one that they can use advantageously in their efforts to obtain requisite legislation in their respective states.

WAR SURPLUS PROBLEM

In the matter of disposal of war surplus equipment and supplies, repeated efforts to obtain reasonable amounts of such materials for the states have proved unavailing. The shifting of disposal authority together with changing personnel made contacts with responsible authorities practically impossible. Even worse, congressional action during the year granting ex-servicemen priorities ahead of state agencies removed all chance for the attainment of our objective. Reversal of governmental policy by the new Congress alone can correct the situation. Our united efforts should be directed to that end.

This year a number of the states have made encouraging progress in developing workable relationships with city and county agencies of government to carry out the provisions of the Federal Aid Highway Act of 1944. Due to the delays occasioned in actual construction work we have not as yet demonstrated our ability to meet the test which these new and important provisions of the law impose upon us. It is of the utmost importance to the future of the highway program that the states meet the situation successfully, through close cooperative relationships with their city and county agencies. We must justify the confidence which the Congress has expressed in the ability of the state governments to administer the federal aid program for all elements of a state-wide highway transportation system, urban and rural alike.

HIGHWAY TRANSPORTATION

Following the end of the war, we have witnessed a strong revival of interest in highway transportation in nations all over the globe. The free movement of goods and persons by motor vehicles has become a basic element in the economy and in the social structure of many nations. It is only natural that men everywhere responsible for development of highway transportation should look to the United States for counsel and assistance. The U. S. Public Roads Administration and the state highway departments will be called upon with increasing frequency to render advice and assistance to the road authorities of other lands. Our association can be of material assistance in the arrangements which this interchange of information will require from time to time. Such cooperation can do much to promote good will between our people and those of other nations.

Members of the association have noted this year with considerable interest the splendid program which our host state has carried on in the field of highway planning. Under the sponsorship of a special bi-partisan legislative committee, and with the Division of Highways and other state departments cooperating, California has made an intensive fact-finding study of future street and highway needs, to serve as the basis for legislative action next year.

CALIFORNIA OUTSTANDING

Substantial progress has been achieved in other states as well, but I mention California as an outstanding example because we are meeting here, and also because the engineering studies which were completed this year are more comprehensive in their scope and in much more usable form than similar projects in the past.

The only proper basis for sound and long-range highway programming is engineering study. The needs are too great, and the amounts of money involved too large, to permit any other kind of approach. But the making of highway planning surveys is by itself not enough. The facts thus obtained must be made available to the public and to the legislatures, so that the problems are understood, and the necessary programs can receive intelligent and informed public support.

In this respect, the California projects this year should be of special interest to all of us, and an inspiration to our own further efforts. They serve to remind us at a timely moment of the tremendous importance of good highway planning to the future progress of our state programs.

He—"Why does a woman say she has been shopping when she hasn't bought anything?"

She—"Probably for the same reason that a man says he has been fishing when he hasn't caught anything."

Evolution of Culvert Design

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subgrade under the box culvert is not acceptable for all sites. It may mean expensive excavation several feet below subgrade in order to lay a blanket of cushioning material. A simple expedient is the answer—put the cushion on top of the box.

We have for that purpose a specification for *Method B* Backfill. For high fills over a box culvert on unyielding subgrade, the embankment is built to a level above the box equal to the height of the box. Then the compacted fill above the box is replaced by an uncompacted fill, or, more simply, the compacted fill is loosened in place by suitable disturbance. Thereafter the rest of the embankment is built compactly over the loose cushion course.

SECTIONAL-PLATE CULVERTS

Recently we had occasion to apply the Marston Theory and the sequel Spangler Theory to the revision of overfill allowances for sectional-plate culverts. One manufacturer in this field proposed a new shaping of corrugations, an increase in depth of corrugations and a larger bolt for assembly of plates.

We found that the shape and depth of corrugations was important only for shallow fills, to resist eccentricity of live superloads and temporary inequalities of backfill pressures. Once backfill has been built 10 feet or so above the top of the pipe, the corrugations are no longer critical. The weakest element is then the bolted longitudinal seam.

Before determining a new policy of overfill limits, we are reviewing the performance of installations made under our former policy. We are considering use of a table of gage requirements for structural resistance and requiring additional thickness of metal for corrosion and abrasion resistance. That is, for a certain fill and diameter, the table might show 5-gage plate to be structurally adequate. To assure the existence of that thickness throughout the design life, we might specify 1-gage plate for the invert and 3-gage plate for the other sections. The extra gage would be determined from experience and some knowledge of bed load of stream and corrosiveness of soil, water, and atmosphere at the site.

RESOLUTION

Michael J. Hoffmann, Commissioner of the Minnesota State Highway Department, who has served as President of the American Association of State Highway Officials for the past year has brought to the responsibilities of that high office not only a long and distinguished service in the highway department of his own state, but a broad comprehension of the needs of an integrated highway system throughout the Nation. During his year as President he has given a wise and able leadership. Upon his retirement from his office we desire to tender to him this official expression of appreciation for his able leadership of our association; his stewardship has been faithfully performed.

CONCLUSION

In conclusion, a few words are in order on the importance of culvert design. A busy bridge engineer, concerned with many projects costing $100,000 to $10,000,000, can't devote much time to any one culvert. However, from the standpoint of mass production, these culverts represent a very large investment in highway plant.

Several years ago we tallied a few road projects and found that 12 percent of the construction cost was for culverts. Last February at a Highway Research Board meeting, the statement was made that drainage structures aggregated 17 percent of highway costs. The proportion varies widely with topography and climate, of course, but we are probably spending well over $1,000,000 each year for culverts on state highways in California, and that may be increased ten fold if recommendations of the Collier Committee are adopted.

To meet this problem of mass production and fit the wide variety of site conditions, standard designs must also provide variety. With skillful selection from such a variety of standards it is expected that future applications of standard culverts will be tantamount to individual designs, obtaining unusual economy and assurance of performance at a very nominal design cost.

California Experience and Practice in Highway Pavement Foundation

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will be imported or selected material of varying thickness with 30 CBR.

The Terminal Island Access roads are still in the grading stage, all of the roadway being an imported borrow embankment which is specified to have greater than 20 CBR and less than 6 P.I. The pavement for these contracts will be 7 inches of asphaltic concrete placed on 6 inches of imported subgrade material having a CBR value of 80 and a P.I. less than 10, with the added provision that the product of the P.I. times the percent passing 200 mesh shall not be greater than 75. This makes the 6 inches of imported subgrade material equal to crushed rock, and gives a total of 13 inches base and surface.

On all contracts, the resident engineers are being trained and instructed to select and save the best cuts for the top layers of the grade.

PROBLEM STILL UNSOLVED

The foregoing will give a little idea of what is being done in this State. We would remind you that the full application of these designs is necessarily limited to the main line heavily travelled roads where the traffic will justify the expenditure. There are many miles in outlying areas where the money that can be expended will build only a stage construction—a part of the ultimate base perhaps—with the hope that it will hold at least for a few years. This condition is particularly aggravated in the timber areas where log and lumber hauling has come up so rapidly. However, the same principle of design should apply, even though the full design cannot be built.

In spite of all the work and study that has been expended, we are still a long way from a final and satisfactory answer to our problem. We hope to be able to improve the tests that we have, or to develop other better and more satisfactory ones. No test is infallible, and there is still plenty of room for judgment based on experience.

It is only an error of judgment to make a mistake, but it argues an infirmity of character to adhere to it when discovered. The Chinese say, "The glory is not in never falling down, but in rising every time you fall."—*Christian Boxee.*

Petroleum Industry and Gas Tax Programs

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ing between our respective organizations.

The serious problems facing highway transportation in this Country today demand all the understanding and intelligent cooperation we can muster. They are the heritage of our past experience and definitely a challenge to our immediate future.

During the quarter of a century between the two World Wars, travel on America's streets and highways skyrocketed to fantastic proportions. Between 1920 and 1940, the increase was nearly 100 percent in average annual mileage per vehicle, and more than 200 percent in the number of motor vehicles registered. The number of miles traveled has thus increased about 500 percent in this period of years.

MARKETS EXPANDED

For the petroleum industry, it meant a tremendous expansion of markets, for after all, gasoline consumption is a direct index of highway use.

For the Country as a whole, this increased travel brought about a profound change in our way of living. Family mobility opened up new horizons for the farmer and the city dweller. When shortages of fuel, rubber and vehicles during the war compelled drastic curtailment of driving, we were jolted into a realization of just how thoroughly our gasoline-powered vehicles had become integrated with day-to-day living, and with our business and industry, education, recreation, and other phases of American life.

PROBLEM OF ENGINEERS

For the highway engineer, the last quarter century has been, above all, a period of strenuous and unrelenting effort to keep up with the mounting demands for highway facilities. An understanding of what happened in these years is essential to a proper judgment of our course for the future.

At first, it was a case of getting traffic out of the mud. The towns in general had surfaced streets, and the major objective was to connect the towns with all-weather roads. The job was undertaken on a vast scale, with the encouragement given by the first Federal Aid Highway Act.

It was fortunate for the Nation that there emerged on the scene in those early days a man of great practical vision and leadership—Thomas H. MacDonald, Commissioner of the Public Roads Administration. Through his administration of the federal aid laws, during his continuous service of more than a quarter of a century, he has brought about classification of roads into designated systems, thus making orderly improvement possible. He encouraged the raising of administrative standards in state highway departments. He worked out a coordinated federal-state relationship in the highway field which has become a landmark in the history of our democracy.

TRIBUTE TO MACDONALD

Then, as now, Chief MacDonald fostered study and research, to develop better techniques of design, construction, maintenance and financing. As the Nation's outstanding authority on highway engineering, his leadership in the immediate years ahead will contribute vitally to the further development of a sound highway program. Such improvements as we envision them must include ways and means of eliminating needless slaughter of citizens on our highways.

With the early improvement of rural highways came the first breath-taking jumps in traffic volume. But increasing traffic was not the only problem. The characteristics of road use themselves changed rapidly.

Thanks to the technological advances made by the automotive industries, including your own, vehicles got bigger, heavier and faster as well as more comfortable. The old crown road managed to get horseless carriages out of the mud, but its usefulness was limited. Highways constructed on a vast scale during the early twenties were in all too many instances obsolete 10 years later, because of the volume and tempo of traffic. They were inadequate as to types of surfacing. They were too narrow, the curves were too sharp, the grades too steep.

TRAFFIC DEMANDS INCREASE

In the three decades since the creation of the federal aid system many roads in that system have been rebuilt two or three times, in a continuing effort to meet the changing traffic demands. Such was the pace of automotive progress.

Yet in spite of these roadbuilding achievements, engineers never succeeded in catching up with traffic demands. Congestion increased on main arteries, at times clogging some of them beyond capacity. Traffic accidents increased. Inside metropolitan areas, and on main roads approaching them, the rate of travel during rush hours slowed down to that of horse and buggy days.

As a result, all sorts of schemes were offered for solution of highway traffic congestion. Elaborate systems of toll roads should be established. Cities should be by-passed. Transcontinental superhighways should criss-cross from coast to coast, and from border to border. This last proposal gained considerable headway.

PLANNING SURVEYS

Meanwhile, there was started in 1935 the highway planning surveys, which were destined to influence the whole course of the road program. These surveys were conducted by the states, in cooperation with the Public Roads Administration. They included a complete inventory of existing highways and a detailed, factual examination of how motor vehicles were being used.

The planning surveys made possible the publication in 1939 of that noteworthy report, entitled, "Toll Roads and Free Roads," which emphasized the significant importance of urban traffic in the highway system. Attempts to by-pass all the traffic around a city just don't make sense when the facts show that most of the traffic on the adjacent rural roads is actually heading for that city.

Some five years later, these facts were utilized by the National Committee on Interregional Highways in developing a plan for a national system of interstate highways. This plan, based on sound engineering study, left no room for the extravagant or grandiose features of the superhighway schemes previously suggested.

A FOUNDATION

But the highway planning surveys have done more than merely block out

impraetieal panaceas. They have given us the foundation of factual information on which sound highway planning must be developed. They have disclosed, for example, the necessity for linking the origin and destination of traffie with the seleetion and location of routes. They provide the data which make it possible to develop improvement programs orderly and responsive to requirements of traffic. In short, their effeet has been to put the highway program on an engineering basis, thus eliminating guesswork and furnishing definite means to combat local pressures. Thus through proper advance planning the motorist has reason to expeet the greatest possible return for his highway dollar.

One of the outstanding lessons learned from the faet-finding teehniques in highway planning is the aeute need to improve highway faeilities in and around our larger urban eenters, partieularly in the more densely populated states. The traditional eheeker-board pattern of eity streets with present parking provisions, is grossly inadequate to handle large volumes of traffie safely and efficiently. Major traffie movements must be eoneentrated on arteries eapable of moving it.

Along with this is the need to improve a limited mileage of interstate roads to high standards, including the controlled aeeess design where volumes justify it. These highways will serve intereity as well as rural travel, and will penetrate the hearts of eities, the destination point for a large share of the traffie.

WAR INTERRUPTION

The planning surveys also diselosed the neeessity for modernizing a large part of our existing rural trunk line mileage. More than half of these highways today are inadequate as to width or type or road surfaee. Likewise the surveys pointed to the need for extensive improvements in a far greater mileage of seeondary roads. This need is partieularly urgent in many of the states with large agrieultural areas and relatively small urban population.

By 1940, many of the states had reaehed the point where they were ready to apply the lessons of the highway planning surveys to large-seale improvement programs. And t h e n eame the war.

Between 1942 and 1946, highway construction was suspended, except for a limited mileage of access routes to factories and natural resources. Normal replaeement of worn-out faeilities was deferred. Maintenance was handieapped by shortages of materials and manpower and in some instances of funds. Meanwhile, traffic was heavy on many routes, and so the pre-war deficiencies were further increased.



Fred F. Grumm, Assistant State Highway Engineer of California, contacts field stations from radio communications headquarters in Biltmore Hotel, Los Angeles

CONGRESS PLANS AHEAD

While construction was at a standstill during the war, ways and means for meeting the augmented highway deficiencies after the war were considered. The facts obtained through the planning surveys were applied in advance engineering studies. Bills were introduced in Congress for an enlarged postwar federal aid program. Congress patiently heard much testimony and gave careful consideration to the urgent needs of the various states throughout the country, particularly to the deficieneies revealed by the planning surveys.

When Congress passed the Federal Aid Highway Act of 1944 granting $500,000,000 annually for the first three postwar years, funds were specifically earmarked for primary highways, secondary farm-to-market roads, and the major arteries in urban areas. Formulas were revised. Whereas funds for years were allotted on the basis of area, road mileage and total population, the new act made urban population the basis for allotting funds for urban highways, while rural population became one of the factors in allotting funds for farm-to-market roads.

Up to the present time allotments have been made for the first two years of the three-year program. The second fiscal year will end next June 30th. I wish I could report to you, on behalf of the members of our Association, that all of the states are going forward on schedule. Unfortunately, such is not the case.

Numerous factors have combined to delay and in fact restrict the program. Many bids have been and are continuing to be rejected on major projects because of current high prices. Right of-way purchases are in many instances being delayed by reason of interference with the housing situation. The shortage of steel has practically stymied the ability of states to make progress on bridge and other structural work. Contractors cannot get much needed equipment. To meet this situation highway officials have from time to time reoriented their programs so as to permit construction of those types of urgent work with which there was the least interference. As a result highway construction work is running nationally, in dollars, close to the level in the years just before the war. The amount of work accomplished, however, will be considerably less, due to higher unit prices. If our situation in Minnesota is typical, the work accomplished will provide a very small part of the highway improvements which the public is demanding since the end of the war.

FEDERAL FUNDS

Federal funds remain available for one year after the end of the fiscal year for which they are allotted. Consequently federal apportionments for the first fiscal year will expire next June 30th, and many of the states will not have taken up their funds at that time. I anticipate that Congress will be urged to extend the availability of those funds, in order to preserve the equities which are provided in the federal aid act.

The cost of rehabilitating our highway plant in the years ahead will be great. One major reason is the high price of land in the urban areas, where many of the urgently needed facilities will have to be constructed. Another reason is the high type of design which is needed on the key segments of our major networks. And in addition there is the backlog of accumulated wartime deficiencies which must be met.

HIGHWAY FINANCE

This naturally leads us to the question of highway finance, which appears to have been the source of many past differences in opinion.

I am convinced that so far as broad, general principles of finances are concerned, the highway officials and the petroleum industry are in substantial accord.

We believe, as you do, that the costs of highways excluding those properly financed in whole or in part by local taxation should be apportioned equitably among beneficiaries of highway transportation, according to the benefits received. We believe that the user imposts for this purpose should be consistent with highway needs that the revenues so raised should be utilized exclusively for highway purposes, and that taxes should be limited to the highway users' ability to pay. We realize the fact that these determinations cannot be readily made with precision.

UP TO PUBLIC

We cannot speak for the users in determining what taxes they should pay. Nor can any industry or other group. That decision is squarely up to the people themselves who foot the bill. In every state the issue finally rests with the highway users and the public.

As to measurement of needs, we believe that the only sound answer lies in factual study. The job is too big, the amounts of money too large, to permit any other kind of approach. On that point, too, I am sure that you concur.

As to the method of raising the highway users' share of the costs, I believe that a combination of license fees and gas taxes is the most equitable. Highways must be planned to take care of the peak loads in rush hours, Sundays and holidays, and the license fee nets as a minimum fee or service charge to help pay for the facilities needed to serve those who drive only occasionally. The gas tax is levied in proportion to the use each taxpayer makes of the highways and on such basis is equitable. I recall that in the twenties when the gas tax was beginning to produce the large revenues which later made possible so much of our highway development, that representatives of your industry shared in the popular viewpoint that this was one tax the people paid without protest

GAS TAX PROTECTION

They will continue to pay these increased road user taxes readily only so long as the funds are used exclusively for the highway purposes for which they are levied. Here I want to digress to point with justifiable pride to the fact that my own state—Minnesota—was the first to dedicate motor vehicle taxes to highway purposes, by constitutional amendment. Subsequently, when our state followed the plan pioneered by Oregon and decided to levy a gas tax, we similarly dedicated those revenues to highway use. Up to date, and not counting states which voted on the question last week,* 17 other states have similarly dedicated their road user funds by constitutional provisions.

When the federal gas tax was first levied in 1932, and throughout the depression and the war years, this tax was also paid without protest because it was an emergency tax. Whether the people will continue to pay it together with other automotive excise taxes in normal times will depend to a large extent upon the use made of this revenue. I am not one of those who would look to Uncle Sam to act as Santa Claus every tme we need more highway funds. I do believe, however, that a substantial amount of federal highway aid is necessary to integrate the state highway systems into one national system, and it seems proper that the Federal Government should levy automotive taxes sufficiently large to offset the amounts appropriated for such highway aid.

MUCH TO BE DONE

Another requisite for ready payment of gas taxes is that the people get from their taxes the modern facilities demanded by modern traffic. That calls for careful planning, for administration of a high caliber, free from harassments of special pressures and devoted to the task of getting the most possible value out of every dollar expended.

Like you, we are much concerned with the problem of tax exemptions and refunds. A great deal needs to be done in several of the states to improve administrative machinery to the end that legitimate claims for tax exemption can be honored, without the serious abuses which tend to creep into the picture.

On these fundamental issues of finance, I am sure you men, as petroleum industry leaders, will agree. I am confident that our approach to other questions likewise may be the same. For example, we share a mutual interest in seeing to it that on controlled-access facilities, the motorists can obtain fuel and other essential services with maximum convenience and economy. We are thoroughly in support of the principle of free enterprise, and as state officials we have no desire to enter into the gasoline, garage or tire business.

Well, if we can admit accord on all these important questions of policy, where, then is there likely occasion for misunderstanding?

LACK OF MUTUAL CONFIDENCE

As I see it, the possibility lies mainly in a lack of mutual confidence. There seems to be a rather definite gap between our agreement in these principles, on the one hand, and the specific positions taken in the several states where the issues arise.

Certainly the petroleum industry in America does not wish to be identified exclusively with efforts to reduce or oppose gasoline taxes, regardless of conditions or needs. By the same token, highway officials are not seeking arbitrarily to increase such taxes. Both concepts are extreme and false. Yet they have been fostered in parts of the Country from time to time with the result that confidence has been weakened, and opportunity lost for helpful cooperation on common problems.

The state highway officials are responsible administrators, facing difficult problems. It is not their purpose to levy or spend revenues which are not required to meet the demands of highway transportation.

COSTLY EXPERIENCE

From the costly experience of the last quarter century, we have learned that early obsolescence of expensive highways must be avoided; that true economy is achieved by designing and building facilities in the first place which will last out their full service life. We recognize, too, the importance of acquiring land for right of way in advance, to keep costs down, and in sufficient width to avoid the enormous penalty of having to purchase additional widths later.

The highway officials have as their objective the providing of roads, streets and bridges which will make expanded highway transportation possible. We believe that this is your objective, too, and one which lies squarely in the public interest.

We ask for understanding, support and cooperation in the task of reaching that goal. We also ask for tolerance; no group of men can claim infallibility. As highway officials, we know we have made mistakes in the past, and will make more in the future. But with your help, and with the help of others who foresee the great benefits which safe and efficient highway transport can confer on the Nation, we are going to move forward with the program as soundly, as efficiently, and as rapidly as we can.

In concluding permit me to express my appreciation for the kind invitation extended to contribute to your program on this occasion.

*Maryland and Texas.



Section of Arroyo Seco Parkway, six-lane freeway connecting Los Angeles and Pasadena, which was viewed by AASHO delegates

Highways and Public Works Concept

(Continued from page 26)

spections. These show that of 187,557 miles, 27,218 miles or 14.5 percent, are in a condition requiring reconstruction. This mileage has deteriorated with age and traffic, or the design is obsolete, resulting in unsafe highways. If this ratio holds on other highways maintained by State highway departments, of the 547,285 miles there would be 65,000 miles in need of reconstruction. How serious is this situation is indicated by the growth of maintenance costs to approximately $750,000,000 this year. This illustrates very well the fact that if replacement is neglected, maintenance costs increase and we substitute the less efficient maintenance dollar for the construction dollar.

On the showing that the desirable safe capacity of a two-lane road is 3,000 vehicles per day, on an annual average, there are in the neighborhood now of 14,000 miles which need to be stepped up to the four-lane design, and these inadequate highways are on the main-traveled routes of the States.

HIGHWAY SAFETY

All of our efforts must be aimed at greater highway and street safety. Since the President's Highway Traffic Safety Conference in May, the downward trend of accidents has been most encouraging. The three committees contemplated by the program adopted by the conference have been formed or are in process of formation. The response of the governors of the states and the highway departments has been splendid. These state safety conferences are the most effective organization of public and official support we have yet had and centers the movement where it can be most effective. The conference committees and the state meetings have received encouragement and material assistance from the Automotive Safety Foundation and other organizations dedicated to the cause of greater traffic safety. Motor vehicle administrators, the state highway police, and the highway departments are in their associations, and as individuals, devoting increasing efforts and are cooperating fully to advance the safety cause.

WORLD INTEREST IN HIGHWAYS

This is an appropriate time for a word of appreciation to the highway officials of the states who have devoted time and attention to the engineers and officials who have visited this country to advance their knowledge of highway construction. During the past months, more than 32 countries have been represented by more than 150 representatives. There has just been formed a World Health Conference to cooperate with the United Nations. Dr. Thomas Perran, Surgeon General of the Public Health Service, who served as president of the conference, said in his address: "The fundamental freedoms can be realized only when the people are healthy and well nourished. Hunger and malnutrition stunt the bodies and warp the minds of a large number of the world's population. To attain freedom from want of food is another goal which we may hope to reach by pooling our nutritional knowledge with the food and agricultural efforts of the United Nations."

The experiences stemming from the construction of the Inter-American Highway in Central America are convincing that food is the key to ability of the individual to produce and the major element in a better standard of living. This conclusion is confirmed by observations in many other parts of the world, but along with this is the equally ruling principle that transportation in the end determines whether people are or can be properly fed. Today, the ability of the United States to feed her own people abundantly and to share great quantities of food with other nations is as much the result of a great transportation plant as it is of the production of the foods themselves. This transportation plant must be carefully and constantly improved. Every element, railways, airways, waterways, as well as highways, must be kept in efficient operation and economic health. We will get the best and most economical service if there is full cooperation between the different forms of transport. It might be desirable to broaden the contacts of this association with the railroads now confined to the gradecrossing improvement program to include other matters of mutual interest. Serious questions immediately arise. We will certainly be wise if we leave transportation as it is in this country and perfect the services through cooperation.

State of California

EARL WARREN, Governor

Department of Public Works

Headquarters Public Works Building, Twelfth and N Streets, Sacramento

CHARLES H. PURCELL, Director of Public Works

A. H. HENDERSON, Assistant Director

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1947

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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State Proposes Second San Francisco Bay Bridge and Oakland Estuary Tubes at Total Cost of $99,300,000

THE CALIFORNIA Department of Public Works, in a report released on February 13, finds that "another bridge spanning San Francisco Bay is necessary and is economically and physically feasible."

A new bridge can be built without increasing tolls on the present San Francisco-Oakland Bay Bridge. Tolls on both structures would be the same.

Preliminary studies indicate the second crossing should be located just north of, and generally parallel to the existing bridge, and would cost, including approaches, an estimated $84,000,000.

This is the conclusion of a "Report Covering Preliminary Studies for an Additional Bridge Between San Francisco and the East Bay Metropolitan Area," filed with the California Toll Bridge Authority by Director of Public Works C. H. Purcell. The study was authorized on October 30, 1945.

Eleven crossing locations were studied in detail.

Submitted also was an estimate of $21,000,000 covering twin two-lane tubes under the Oakland Estuary with connections to the East Bayshore Freeway and to Alameda. In these two figures is an "interest during construction" item of $5,700,000. Total cost of the bridge, Alameda tubes, and the approaches is $99,300,000, exclusive of interest during the construction period.

"Proposed revenue bonds to finance the new span, supported by earnings from the present bridge which will be entirely paid for by 1953, will be self-liquidating, with such certainty as to attract investors to purchase," Director Purcell predicts.

WOULD PARALLEL PRESENT SPAN

The second bridge, the report recommends, should be built on a line between Rincon Hill and the Key System Mole via Yerba Buena Island, north of and approximately parallel to the present bridge. A number of advantages to a crossing in this location are pointed out by the state engineers.

The proposed two-deck structure would be about 300 feet from the present bridge and would support five 12-foot lanes on each deck. Plans would permit one-way flow of traffic on each bridge, if desired.

No provision is made for steam train traffic. The report points out that on a high-level structure north of Hunter Point the rail elevation will be 200 feet above the elevation of the terminals, and since approach grades of 1 percent are the maximum that can be effectively operated over by passenger trains or short freight trains, and then only at slow speed, it would require over four miles of approach between the bridge and the rail terminals.

"The cost of providing railroad tracks through a tube may be practically divorced from that of providing for vehicular traffic since separate tubes and terminal facilities are required," the report says.

25,000,000 VEHICLES IN 1946

The parallel location was favored after it was determined that only about 5 percent of the present vehicular bridge traffic of 25,300,000 vehicles would be diverted if another crossing were located on a line between Hunter Point and Bay Farm Island; and that only 20 percent would be diverted to a second bridge between Potrero Point and the southerly line of Alameda.

No location other than one in close proximity to the existing bridge is likely to divert anything like half the traffic now using the San Francisco-Oakland Bay Bridge, the report shows, while "congestion on the present bridge cannot be relieved for very long, or to any great degree, by the construction of a second bridge south of the general vicinity of Yerba Buena Island," the report emphasizes. "Traffic studies indicate that the more remote the new location is from the existing one, the less traffic it will divert from the already crowded structure." It was pointed out, further, that "there should be no toll differential."

NUMEROUS SITES STUDIED

Four terminal locations in San Francisco and four on the East Bay side were studied by the state engineers before recommending the parallel location. In San Francisco they were: Telegraph Hill, Rincon Hill, Potrero Point, and Hunter Point. On the East Bay side: Key Route Mole, Oakland Mole, the southerly line of Alameda, and Bay Farm Island.

NO ADDITIONAL INTERURBAN RAILS

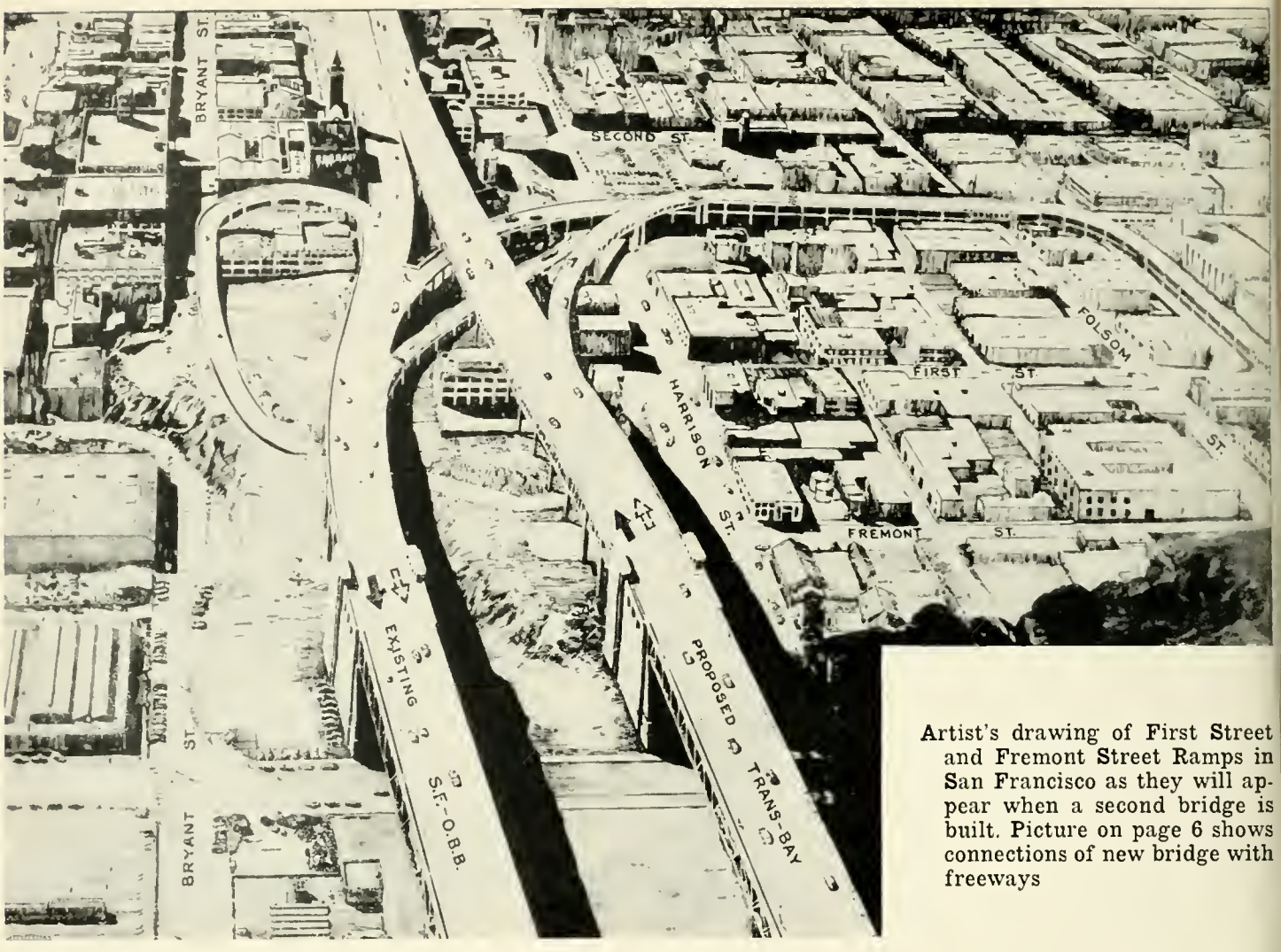
No additional interurban rail transportation facilities are contemplated

ESTIMATED COST

THE FOLLOWING costs for the recommended bridge and its approach connections have been estimated on the basis of known quantities and costs of constructing the San Francisco-Oakland Bay Bridge. The costs have been modified to conform to present-day prices and methods of construction.

(000 OMITTED)		
Bay and island crossings	$62,350	
Electrical, buildings and miscellaneous work	1,190	
San Francisco main approach	1,260	
Total main bridge construction		$64,800
San Francisco approach connections	$940	
Oakland approach connections	4,760	
Total approach construction		5,700
Property		4,300
Engineering, legal and insurance costs		4,500
Interest, during construction		4,700
Total, bridge and immediate approaches		$84,000
Twin two-lane tubes under Oakland Estuary with connections to the East Bayshore Freeway and to Alameda—		
Construction costs	$18,000	
Engineering and general costs	2,000	
Interest during construction	1,000	
Total, Estuary crossing		21,000
Grand total		$105,000

It will be noted that the above figures include interest during construction which, because of the fact that interest is paid from San Francisco-Oakland Bay Bridge revenues, is only a book charge. The cost, exclusive of interest, of the bridge and the Estuary crossing is seen to be $99,300



Artist's drawing of First Street and Fremont Street Ramps in San Francisco as they will appear when a second bridge is built. Picture on page 6 shows connections of new bridge with freeways

in the report. It says in this connection: "Since the Bridge Railway is capable of handling twice as many passengers as now use it, and can be made to handle more if necessary, no provision for additional rail facilities seems justified."

Of other facilities on the lower deck the report finds that "While it cannot be said that with the present traffic pattern the present economic capacity of the lower deck (truck and bus) has been reached, it is close to the desirable limit."

"The number of passengers carried by the Bridge Railway, including government employees going to and from Treasure Island, rose to 37,000,000 for the year 1945, 11,000,000 of which were government toll-free passengers. Because of the large decrease in war activities, indications are that train passengers will not exceed 22,000,000 during 1947."

PRIVATE VEHICLES PAY BULK OF TOLL

The study shows transbay passenger traffic and revenue. Using 1945 figures, privately owned vehicles carried 45 percent of the passengers, busses and interurban trains 53 percent, while steam trains (crossing by ferry and bus, exclusive of military) amounted to 2 percent.

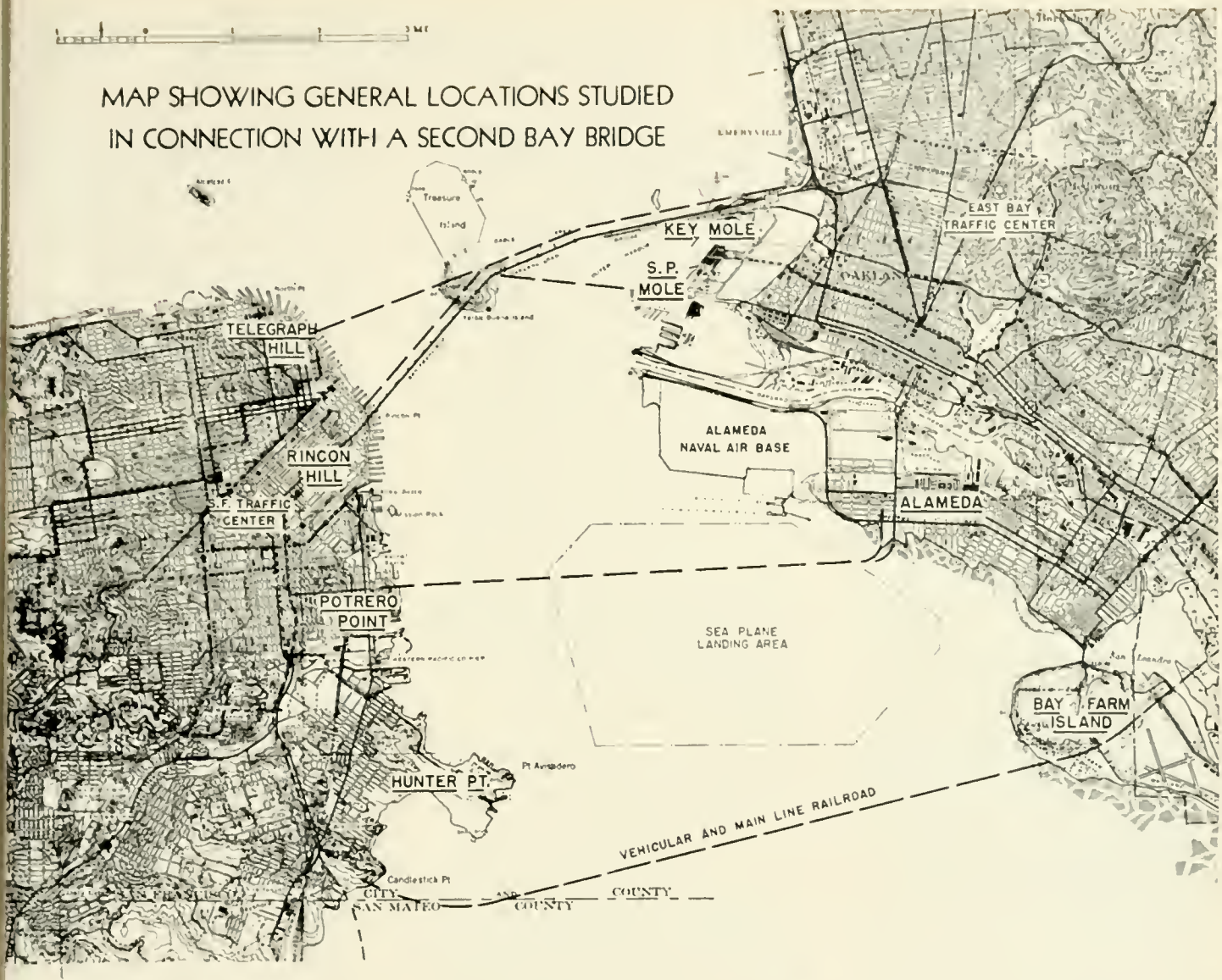
Revenue collected in 1945 shows 63 percent was from light passenger vehicles, producing $4,357,000; trucks numbering 1,377,000 or 20 percent, yielded $1,377,000. Privately owned vehicles therefore returned $5,734,000 or 83 percent of the revenue.

The yield from bus, Key System, Greyhound, Santa Fe, etc., was $536,000; from Key trains, $631,000, a total of $1,167,000 or 17 percent of the overall annual $6,901,000 return. The additional $1,000,000 earned in 1946 was obtained through an increase in privately owned vehicles only.

TRAFFIC TWICE ORIGINAL ESTIMATES

The report shows that present traffic is twice the originally anticipated amount, flowing now at a rate not predicted until 1970. In 1946, the bridge traffic was 69,000 vehicles daily, divided 63,000 on the upper deck and 6,000 on the lower. Peak day was Easter Sunday, April 21, 1946, with 79,016, of which 76,609 were handled on the upper deck.

Traffic increased materially during the war, although rationing of gasoline afforded some relief. When rationing ended August 15, 1945, the problem became acute and need for a second crossing became immediately apparent, Purcell declared. This is borne out by the changing traffic pattern. In 1940 the greatest traffic was over the week-end. At present, traffic on the five working days is greater.



IMPORTANT AS INTER-CITY ARTERY

"This change indicates the growing use of the bridge as an inter-city business artery. The maximum hourly peak established on October 8, 1946, between 4.45 and 5.45 p.m. and largely inter-city, was 7,300 vehicles." During peak hours the stopping of one lane by wrecks or stalled cars, and from entering streams of side traffic, "reduces the effectiveness of the remaining two lanes by more than half."

The origin and destination count, and distribution of vehicular traffic, further shows that 55 percent stops in the principal downtown area of San Francisco, both north and south of Market Street, and 79 percent stops or starts in this downtown area and the part of the city directly west and north of it, and also Treasure Island.

On the East Bay side, of all present bridge traffic, 65 percent stops or starts north and west of a line following Fourteenth Street, Lake Merritt, MacArthur Boulevard and High Street in Oakland.

Direct traffic between the southerly portion of San Francisco and that portion of the East Bay cities south and east of the above described line, amounts to only 8 percent of the bridge traffic. Direct traffic between the northerly areas on each side amounts to 50 percent, or six times as much.

Nine reasons are cited by the State's engineers for their recommendation that a second bridge be built on a line between Rincon Hill and Key System Mole via Yerba Buena Island. First, they agree "it should make suitable connections with all the important traffic centers and be so located and constructed that high-speed connections to other areas are feasible as soon as their development warrants them." The advantages given are:

(1) It affords the greatest and longest-lasting relief for the traffic congestion on the present Bay Bridge.

(2) The cost per additional transbay traffic lane is less than that of other practicable crossings. This is due to the type of structure, the favorable foundation conditions and the use of proven construction methods.

(3) The time and cost of engineering investigation and design will be less than for any other crossing, since plans for the present bridge can be used as a pattern for the new structure.

(Continued on page 6)

PERTINENT FACTS CONCERNING A S

Q. What are the main purposes of a second crossing to consider in choosing its location?

A. (1) To reduce the congestion on the present bridge, (2) to provide a practical means of reaching all parts where future development is likely to occur.

Q. How will a second bridge in the vicinity of Rincon Hill best fulfill these requirements?

A. It will reduce traffic on the present bridge more than would any other crossing, it will serve the Mission District and the northwesterly areas via the Bayshore Freeway and connections, and, will serve the Potrero and Bay Vista districts through a connection to the proposed Maritime Freeway, or such portion of it as is needed by future developments.

Q. What type of structure would be built at this location?

A. A bridge generally the same as the existing one having equal roadway capacity and jointly operated with it.

LOCATIONS FOR A SECOND BAY BRIDGE

Q. What terminal locations in San Francisco were studied in arriving at this conclusion?

A. The physiography of the Peninsula provides favorable conditions for a terminus in four general areas: (1) Telegraph Hill; (2) Rincon Hill; (3) Potrero Point; and, (4) Hunter Point.

Q. What terminal locations on the East Bay side were studied?

A. (1) Key Route Mole; (2) Oakland Mole; (3) the southerly line of Alameda; and, (4) Bay Farm Island.

Q. What features limit the choice of locations in the East Bay area?

A. The general geography of the area, its harbor and airfield developments. (Oakland Harbor entrances, Alameda Naval Air Station, etc.)

FOUNDATION CONDITIONS

Q. Why do the northerly locations cross Yerba Buena Island?

A. Because the most favorable foundation conditions for a long-span bridge occur on lines through that point.

Q. Where is the most favorable foundation condition to be found?

A. On the general line of the present bridge between Rincon Hill and Yerba Buena Island.

Q. Is rock or hard material found south or east of the island at a reasonable depth?

A. No. It would be necessary to support bridge piers or tubes on piling increasing the cost of substructure greatly, particularly in the case of long spans.

COMPARISON OF CROSSING TERMINI

Q. What are the advantages of a crossing terminus in the Rincon Hill area as compared to one in the Telegraph Hill area?

A. (1) It is closer to the greater volume of downtown area traffic which starts and stops to the south of Market Street., (2) the topography, the property development and the street plan is relatively favorable for connections, (3) it provides direct connection with the Bayshore Freeway and its connections, (4) direct connections can be built to serve the Potrero and other more southerly districts, (5) it permits utmost flexibility in handling traffic together with the present bridge, and, (6) foundation conditions for the West Bay crossing are better.

Q. What are the disadvantages of a crossing terminus on the Oakland Mole as compared to one on Key Route Mole?

A. (1) It must remain at high level and have a long span (say 1,400 feet) near the end of the mole, (2) foundation conditions for the piers are poor, (3) the superstructure elevation interferes with the line of flight of Navy planes, and, (4) the structure cannot reach street grade until near Peralta Street, Oakland.

Q. How many lines terminating on Telegraph Hill were studied?

A. Three, in order to compare their suitability for terminal connections and to study various span arrangements for the West Bay crossing.

Q. How many lines terminating near Key Mole were studied?

A. Three, one on the direct line of Stanford Avenue, one parallel and to the north of the present bridge and one on the direct line of 22d Street.

Q. Which of the three lines crossing the East Bay is perferable?

A. The line parallel to the present bridge because: (1) Connections to both Stanford Avenue and to 22d Street can be built from it, (2) it provides a more flexible traffic-handling combination with the present bridge, (3) it does not interfere with the yards and harbor development south of the bridge.

Q. Granted that a crossing parallel to the present bridge is the best one of any combination of termini that cross Yerba Buena Island, why should the second bridge be built to the north of the present one?

A. (1) The Bridge Railway interferes with the construction of connections on the south side of the present bridge, (2) although the foundations for the West Bay crossing for bridge to the south are somewhat more favorable, a crossing of the island to the north provides for better support and road connections, and, (3) there is less interference with existing development if built along the north side of the Key Mole.

DISTRIBUTION OF TRANSBAY VEHICULAR TRAFFIC

Q. How was the distribution determined for these studies?

OND SAN FRANCISCO BAY BRIDGE

A. Chiefly by origin-destination counts taken on the San Francisco-Oakland Bay Bridge which are checked by other traffic counts in the terminal areas.

Q. When were these counts taken?

A. November, 1943, and March 1946.

Q. What changes in traffic were indicated?

A. As would be expected, the 1946 count showed fewer vehicles starting and stopping in zones that included such war activities as the shipyards in Richmond and the Oakland Port of Embarkation.

Q. What proportion of the traffic starts and stops in the downtown section of San Francisco?

A. Fifty-five percent.

Q. What proportion is directly tributary to a bridge via Yerba Buena Island as compared to a location farther south?

A. About three-quarters of the traffic starting or stopping on the San Francisco side and two-thirds of that on the East Bay side.

Q. How much vehicular traffic would be diverted from the present bridge by a crossing on the Hunter Point-Bay Farm Island line?

A. About 5 percent.

Q. How much by a Potrero Point-Alameda line?

A. Probably not over 20 percent.

Q. Where are the centers of gravity of vehicular traffic on each side of the Bay located?

A. About Eighth and Mission Streets in San Francisco and Broadway and Mather Streets in Oakland.

Q. Have these centers changed since 1932 (Hoover-Young Report)?

A. The center in San Francisco has apparently moved south and west; the center in the East Bay area has moved north and west.

Q. What proportion of traffic starts and stops beyond the city limits.

A. San Francisco: North, 0.9 percent; South, 3.4 percent. East Bay Cities: North and east, 7.7 percent; South, 4.9 percent.

Q. What proportion of the bridge traffic is completely intercity?

A. About 83 percent.

PRESENT CONDITIONS

Q. What provisions were made for traffic on the present bridge?

A. Six lanes for autos on the upper deck; three lanes for trucks and busses and two tracks for interurban trains on the lower deck.

Q. What volume of traffic is carried on the present bridge?

A. 25,300,000 revenue and toll-free vehicles cross the bridge in 1946 (69,500 vehicles per day). Nine percent of these vehicles used the lower deck.

Q. What was the total number of passengers crossing the bay in 1946?

A. About 88,000,000.

Q. How did they travel?

A. Forty-five percent in privately owned vehicles, 53 percent in busses and interurban trains and 2 percent were handled by the three steam railroads.

Q. How much revenue was contributed by each?

A. Privately owned vehicles contributed 83 percent and busses and Key trains contributed 17 percent.

Q. What is the estimated vehicular capacity of the present bridge?

A. With little likelihood of a change in the traffic pattern the maximum limit for reasonable safety and tolerable delay is estimated to be 85,000 vehicles per day. This would mean an average of not over 75,000 vehicles per day.

Q. Is traffic on the Bridge Railway nearing its ultimate capacity?

A. No. It is now only about half the volume carried during the peak of war conditions and gas rationing.

Q. Can the capacity of the present bridge be increased?

A. Certain improvements, such as additional toll gates, are to be constructed which will alleviate the peak hour congestion to some extent, but will not appreciably affect the time of reaching capacity volume.

BRIDGE RAILWAY

Q. Can the present Bridge Railway be replaced by busses?

A. No. Under present conditions, and until more roadway for busses can be provided, trains are necessary to handle the peak-hour traffic.

Q. How many passengers are carried by the railway?

A. In 1945, 37,000,000 passengers were carried of which 11,000,000 were government toll-free. It appears, however, that with the decrease in war activities and other apparent changes in traffic habits that train passengers in 1947 will not exceed 22,000,000.

Q. Are additional facilities for interurban trains necessary on a second crossing?

A. Since the Bridge Railway has handled nearly twice as many passengers as now use it, and could be made to handle more, no additional tracks seem necessary.

Q. Is bus passenger traffic increasing?

A. Yes, at a fairly steady rate, the increase of traffic in 1946 over 1945 was about 3 percent.

MAIN LINE RAILROADS

Q. How is San Francisco freight handled at the present time?

A. By the Southern Pacific over its Dumbarton Cut-off to its yards at the south limits of San Francisco. By the Western Pacific and the Santa Fe on car ferries.

(Continued on page 25)

State Proposes Second San Francisco Bay Bridge and Oakland Estuary Tubes

(Continued from page 3)

(4) Substantially lower costs of administration, operation and maintenance will be possible.

(5) Many duplications of present operating facilities and appurtenances can be avoided.

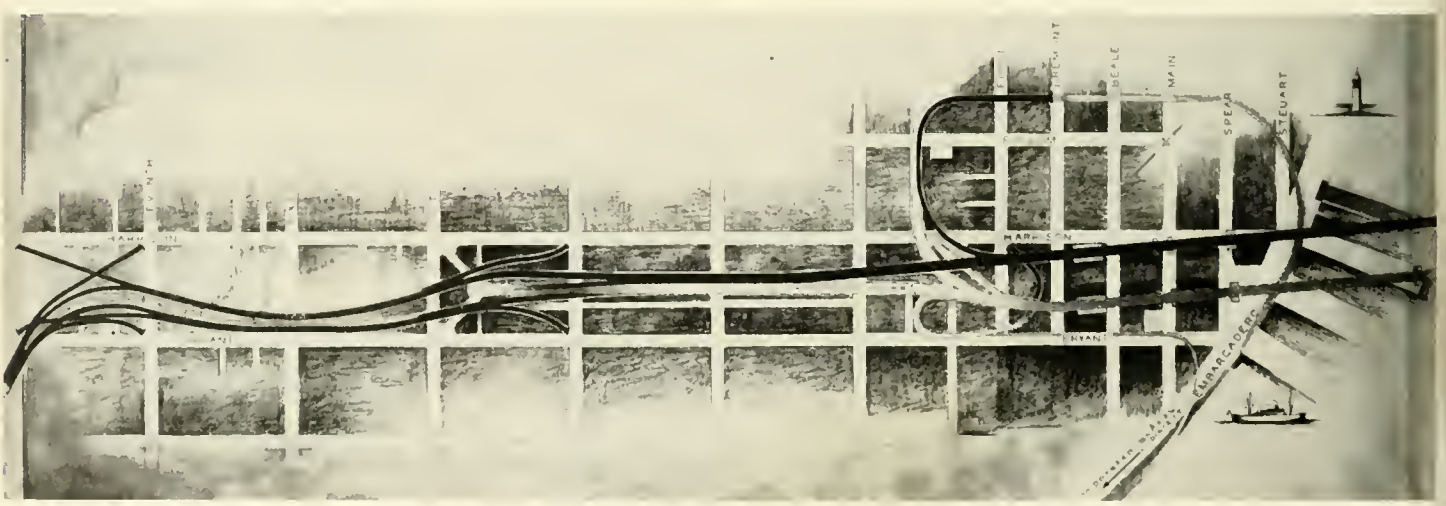
(6) The two structures in close proximity lend themselves to the greatest flexibility of operation. They can be operated each as a one-way bridge, which arrangement could be modified in order to meet future traffic needs and patterns.

(7) No additional hazard to navigation, interference with anchorage areas or obstruction of the glide angle for airplanes will result from its construction.

(8) It will connect directly with the Bayshore Freeway in San Francisco to be built by the State, providing four points of distribution in the downtown business district. Extensions reaching to the north of Market Street, to Van Ness Avenue, and south to the Potrero-Bay View districts via the proposed Maritime Freeway, are practicable.

(9) It terminates at the focal point of East Bay traffic arteries connecting with the East Bayshore Freeway (north and south) and MacArthur Boulevard. Additional traffic capacity of the terminal arteries will be obtained (a) by adding lanes to the present distribution structure for north-south, city traffic, (b) by the construction of a connection with 22d Street across the S. P. Co. tracks, and (c) by additional tubes under the Estuary connecting Alameda with the Bayshore Freeway.

"The proved financial soundness of the existing bridge should assure a ready market for new bonds secured by the same steady revenues. In fact, with two crossings, the risk of loss of revenue because of damage to either unit will be greatly reduced and the value of the securities should be enhanced by the assurance of steady revenue," Director Purcell declares in the report.



Bridge connections with Bayshore Freeway and with projected Shoreline Freeway

BACKGROUND DATA

The California Toll Bridge Authority directed the present investigation on October 30, 1945, and Congress followed in March, 1946, with an authorization for another Joint Army-Navy Board to study the problem from the standpoint of national defense and peacetime economy.

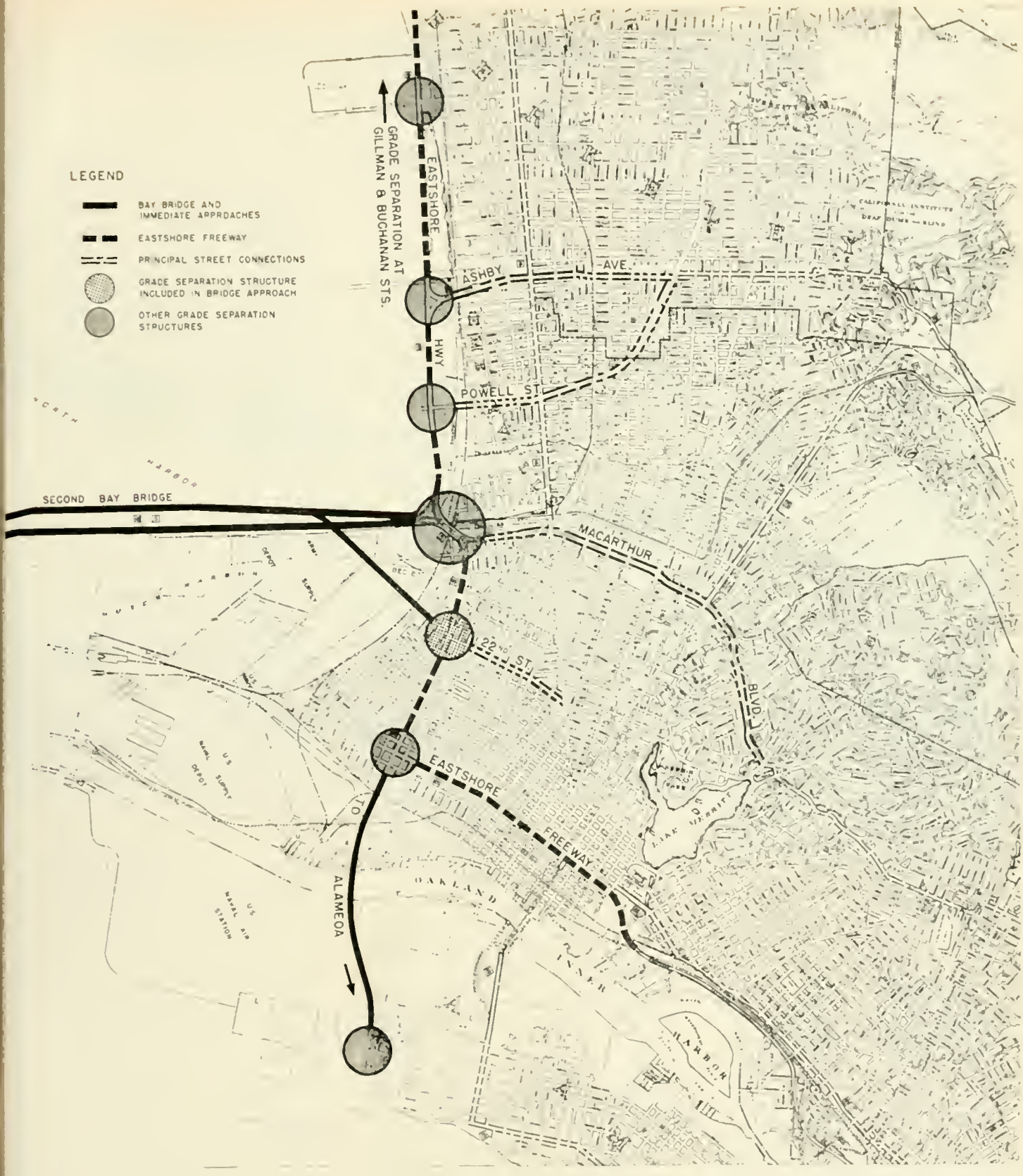
The State's investigation was done by a special Bay Bridge Studies organization, under the general supervision of Director of Public Works Purcell and chief engineer of the San Francisco-Oakland Bay Bridge, and the immediate direction of F. W. Panhorst, bridge engineer of the California Division of Highways.

The investigation included detailed studies of traffic volumes and capacity of the existing bridge to determine the need for an additional bridge. A general study was made of alternate locations.

Embraced in the report are origin and destination studies in detail, available and potential terminal distributive highways and streets, foundation studies, and design and cost studies.

In 1930, as part of its studies for the Hoover-Young Commission, the department made borings which, supplemented by actual construction record for the Bay Bridge, give a reliable idea of bedrock and these explorations were useful to the current study. In addition, new borings were made for the present study, particularly for comparison of locations each side of the existing bridge.

The San Francisco-Oakland Bay Bridge was opened to traffic on November 12, 1936. Continued increase of traffic on the Bay Bridge since that date has been far beyond the most optimistic estimates.


LEGEND
BAY BRIDGE AND IMMEDIATE APPRDACHES
EASTSHORE FREEWAY
PRINCIPAL STREET CONNECTIONS
GRADE SEPARATION STRUCTURE INCLUDED IN BRIDGE APPROACH
OTHER GRADE SEPARATION STRUCTURES
GRADE SEPARATION AT GILLMAN & BUCHANAN STS.
EASTSHORE HWY
ASHBY AVE.
POWELL ST.
SECOND BAY BRIDGE
MACARTHUR BLVD.
22ND ST.
EASTSHORE FREEWAY
TO ALAMEDA
OAKLAND
HARBOR

Foundation Exploration In San Francisco Bay

Everett L. Walsh, Senior Bridge Engineer



Drill barge taking borings on east side of San Francisco Bay. San Francisco-Oakland Bay Bridge in background

STRANGE jargon has been drifting about the air in the Bridge Department for the past few months. Some of the engineers have suddenly gone nautical. Such terms as "starboard," "port," "stern" and "aft," have replaced the usual engineering terminology. All of this was due to the unusual activity of exploring the subsurface formations of San Francisco Bay to determine foundation conditions for another crossing between San Francisco and the East Bay.

On October 30, 1945, the California Toll Bridge Authority requested the Department of Public Works to make a comprehensive engineering investigation and study of the need for an additional bridge from San Francisco to the East Bay without limitation as to location.

It is impossible to determine the relative economy or even the feasibility of any proposed crossing either as to its type or location without definite knowledge of the subsurface formation. The job of probing the strata below the earth's surface on land is comparatively simple and the methods employed vary with the type of information desired and the relative suitability and economy of the method chosen. However, when it becomes necessary to take borings in tidal waters ranging in depth to over 100 feet, the problem becomes more difficult.

FOUNDATION INFORMATION

It was necessary to obtain foundation information on various lines starting from various points between Hunter Point and Telegraph Hill, a stretch of approximately seven miles.

Prior to the construction of the present San Francisco-Oakland Bay Bridge, 41 borings were taken at various locations in San Francisco Bay by the Department of Public Works for the Hoover-Young Commission. While these borings were of general value in that they indicate a great irregularity of formation and depth to rock and showed the general suitability of the present bridge location, they were of little value in predetermining accurate foundation conditions on any particular crossing location other than the existing one. The depth of suitable rock foundation on the present bridge between the San Francisco pier head line and Yerba Buena Island varies from 88 to 231 feet below mean lower low water with a variation of rock elevation of 30 feet within the area of one pier.

JET BORINGS

The results of past experience indicated that the most practicable and economical method of determining whether any of the prospective lines afford suitable foundation at practical depth is by means of exploration with a high pressure water jet, and this method was employed to obtain samples along each of the proposed crossings. The suitability of this method of predetermining foundation conditions was definitely demonstrated by satisfactory results obtained during the construction of the present bridge. The jet borings for the study were necessarily exploratory in nature, their purpose being to determine general characteristics and material penetrated, and the distance to suitable rock formation when rock was encountered within the limits penetrated.

The method of making borings did not permit samples to be obtained at all strata penetrated nor core borings for a complete laboratory analysis. Nevertheless the information obtained by the use of the jet provided sufficient information to assist in, (1) a determination of the relative suitability and feasibility of the various proposed lines, (2) the selection of the most practicable type of structure as a basis for preliminary designs and cost estimates.

CONTRACT SET

As soon as the funds became available, specifications were prepared and bids were received to have the borings done by contract on an equipment rental basis. A service agreement was issued to Ben G. Gerwick, Inc. Work was started on September 20, 1946, and completed on December 6, 1946.

The borings were made from a drill barge which had an over-all length of 82 feet and a beam of 29½ feet. The barge carried 100-foot pile driver leads. On the deck of the barge at the bottom of the leads a working platform was cantilevered out ahead of the leads to provide a working space for the control of the jet pipe.

A tug boat was used to tow the drill barge from the mooring to the location of the jet borings or from one boring location to another. The tug remained with the drill barge at all times while work was in progress.

A gasoline launch was used to transport the crew and state engineers from the shore to the barge and stood by at all times during jetting operations.



Close-up of jet nozzle. Four-inch pipe reduced to two inches

LOCATING BORINGS

Two engineers of the department, George A. Baab and Richard W. Douglas, were on the drill barge at all times directing operations. The location of the proposed borings and of various land marks, such as permanent buildings, towers, smoke stacks, radio towers, high water tanks, etc., were shown on a print especially prepared from U. S. Coast and Geodetic coordinates, plotted with a scale of 1 inch = 1,000 feet. In locating the barge over a proposed boring, three visible land marks were selected and the angles between the borings and the land marks were measured by means of a sextant and transferred to the print by means of the three-armed protractor. The sextants were supplied with telescope attachments which greatly facilitated their use.

ANCHORING REQUIRED

To hold the barge at the desired location an adequate anchorage system was required. This was provided by a system of stern, bow and quarter anchors. Generally the stern anchors were dropped first with the stern of the barge against the run of the tide. This allowed a certain amount of control of the barge while getting it into position to drop the quarter anchors. After the two stern anchors and two quarter anchors were in place the bow anchor was lashed to the bow of the

tug. The tug then carried the anchor until it was over the location where the bow anchor was to be placed. When all anchors were down the leads of the barge were brought over the boring location by use of winches on the anchor line.

All anchors except the bow anchors were dropped directly from the barge and all anchors were raised by deck engines after the barge had been maneuvered directly over the anchor by use of winches.

SUBMARINE CABLES

About 50 percent of the borings were made within or near the vicinity of the areas occupied by submarine cables of the Pacific Telephone and Telegraph Company, Western Union and the Pacific Gas and Electric Company. Some of these cables carried as many as 1,200 conductors and extreme care had to be exercised that an anchor was not dropped on or close to one of these transmission cables as the breakage of one of the cables would seriously disrupt communication into San Francisco.

The Pacific Telephone and Telegraph Company cables were shown on a print prepared by that company. This print was made on the basis of "Range Lines" which represented 20-minute angles between three prominent landmarks. From these range lines it was possible to read directly the angle between the proposed anchor setting and the landmarks. These angles were set on the sextants and the barge towed in the direction necessary to be over the desired spot.

The system for locating the submarine cables used by the Western Union Company was somewhat different. Prior to the setting of the anchors a "tone" was put into the cables. This "tone" was a make-and-break signal with a cycle of from two to three seconds. After starting the "tone" from the shore stations the company's representatives came aboard the barge with an exploring coil. By means of this coil, an antenna and earphones, the "tone" could be heard from the surface of the Bay. This "tone" or make-and-break signal increased in volume as the barge approached a cable and became maximum when the antenna was directly over the cable.

Through long experience with this equipment the Western Union representatives were able to estimate the distance from a cable quite accurately by volume of the "tone" in the earphones and could thereby judge when it was safe to drop the anchors. Because of the interference produced by the "tone" on communications being carried by the cable, the "tone" was not put into the cable until the barge was nearly on point and was removed again as soon as the anchors were set. The Telephone Company was also equipped to use this method of locating cables, but because the "tone" is audible and creates interference on transbay telephone conversations, it was not used.

The Pacific Gas and Electric Company located its cables by means of a three-stage audio-amplifier which picks up the 60 cycle field of the cable by antenna and is heard as a steady hum in the earphones. The hum approaches a maximum as the cable is approached, but directly over the cable the hum stops and the ear phones are dead. By using extreme caution in locating the anchors in the cable area, no particular trouble was encountered and no damage was done to any of the cables.



Sampler tube. This tube is weighted with lead to resist bouyancy

JETTING AND PROTECTIVE CASING

In shallow depths no extraordinary precautions were required to protect the jet pipe. When jetting operations were performed at locations where the depth of water was over 80 feet the jet pipe was protected from the swift tidal currents by first lowering a 12 inch pipe of extra heavy strength. This

pipe came in 36-foot sections with flange connections which were bolted together. After sufficient pipe had been connected and lowered to touch bottom the pipe was set into the mud as far as possible by dropping the pile hammer on it.

As soon as the leads of the barge were on the point desired and the protective casing had been lowered where required, the tip section of the jet pipe was lowered inside the casing. The tip section was made up of four 20-foot pieces of 4-inch pipe plus a 2-foot nozzle with a reduced orifice from 4 inches to 2 inches. Except in very shallow water the tip section would usually lower itself through the soft surface mud by its own weight. Additional jet pipe was added as necessary in 60-foot pieces made up of 20-foot sections of the 4-inch pipe. Sections of this length were used in order to speed up the jetting operations by reducing the time consumed in making and breaking the joints.

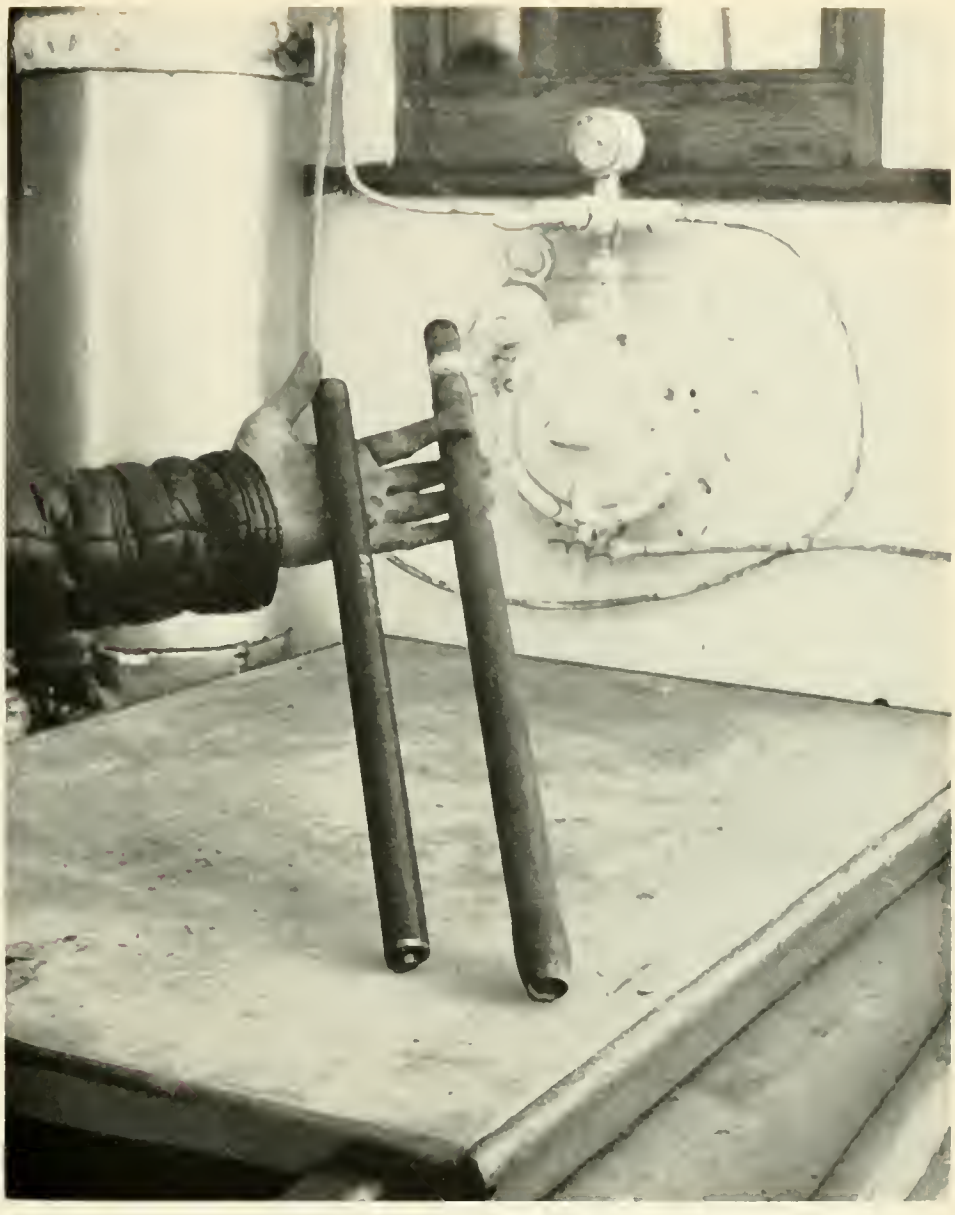
All jet pipe was 4 inches extra heavy strength tested to 1,200 pounds per square inch. The individual lengths were connected by threaded couplers, and the couplers were welded to the pipe to prevent breakage at the joints except at the sectional intervals. Connections of jet pipe sections were made from the working platform on a level with the bridge deck in front of the leads. Jet pipe when not in use was lashed to the bracing at the sides of the leads.

SYSTEM OF PUMPS

A system of pumps was used which developed gauge pressures of 500 pounds per square inch when the nozzle of the jet pipe was in a stratum which afforded this much resistance. However, pressures of this magnitude were not sustained for any appreciable period. The average pressure on the jet line was about 330 pounds per square inch. Jet borings were made to a maximum depth of 350 feet below mean lower low water. The jetting operations proved very successful in penetrating all types of subsurface materials to bedrock when such was encountered.

OBTAINING SAMPLES

Samples of the subsurface material were usually taken at depths where it was necessary to stop jetting to add another section of pipe, or at about 60-foot intervals. Samples could be taken at any desired interval, however, by removing a special sampling cap from the tip of the goose neck. Samples were obtained by means of an especially made sampler tube and tip. The sampler tube was constructed of a 12-foot section of two-inch pipe with a three-fourth inch pipe inside. The interstice between the pipes was filled with lead and both pipes and lead were perforated with one-fourth inch holes at from 6 inch to 12 inch centers. The purpose of the lead pipes was to give sufficient weight to overcome buoyancy of the water and to give sufficient weight to drive the sampler tip into the soft clay and soft shale strata.



Sampler tips. Cutting point on right used for hard material

Two types of sampler tips were used. One with a section of three-fourth inch pipe 18 inches long which screwed into the bottom of the sampler tube. Inside the bottom 12 inches of the tip was fastened a one-half inch ship auger. The auger protruded from the bottom of the three-fourth inch pipe about one-half inch and its purpose was to hold any material which the tip penetrated. The second type was a piece of tube (No. 1 soil tube) about 18 inches long, welded at the upper end to a short piece of threaded three-fourths inch pipe which screwed into the sampler tube. This sampler tip had on the lower end a No. 1 cutting point made of specially hardened steel and was used for obtaining samples of hard material which the other type of tip failed to penetrate.

(Continued on page 25)

Plans Are Being Completed for Much Needed Underpass In Roseville

By GEORGE W. SMITH, Associate Bridge Engineer

AT THIS writing plans are practically complete for the construction of the Roseville Underpass under the Southern Pacific tracks in the town of Roseville, Placer County.

Roseville, situated in the Sacramento Valley some 20 miles northeast of Sacramento, is a town of some 8,000 population. It is a division point on the Southern Pacific Railroad, many of its people obtaining their livelihood as employees of the railroad company. The railroad divides the town practically in half. What is now known as the old business district is located on the north side of the tracks, while the business district which has grown up in recent years is on the south side along with some of the newer housing units.

State Highway Route 3, also known as U. S. Highway 99E, now crosses the railroad at grade on Lincoln Street, and is one of the main routes of travel between Sacramento and other towns in the valley located to the north. As U. S. Highway 99 it begins at the Mexican border in the south and traverses the San Joaquin and Sacramento Valleys, goes through the state of Oregon and Washington to the Canadian border.

REALIGNMENT OF U. S. 99E

The proposed underpass will be part of a project of realignment of U. S. 99E through the town of Roseville. The project begins at the intersection of Grant and Vernon Streets, extends one block southerly along Grant to Oak Street, thence one block easterly to Washington Street, along Washington Street, thence across a residential section, finally meeting the present highway at a point one mile north of the present Andora Underpass, comprising a total length of about three miles. From Oak Street to a point just south of the Andora Underpass the proposed construction will be a four-lane divided highway.

Extension of the realignment through the Andora Underpass will alleviate a bad alignment condition which has existed for a number of years. This underpass has been the site of two spectacular gasoline tank truck accidents in which the gasoline ignited and burned the railroad ties such that disruption was caused to both highway and railroad traffic.

TRAFFIC IS HEAVY

A traffic count taken at the present crossing in September of 1945 during a 16-hour period, showed that 6,800 vehicles crossed the tracks. Over 50 percent of the vehicular travel is of local origin and destination, the remainder being through travel. Within this 16-hour period the crossing was blocked 176 times for a total of seven hours. Being close to the north end of the railroad yards, the number of times the crossing is blocked is due primarily to switching movements, as freight trains moving over the Sierras are regrouped in the yard. Approximate number of through trains is 40 daily, this figure comprising both passenger and freight.

ACCIDENTS NUMEROUS

Since 1926 there have been 93 recorded accidents at the crossing involving trains and vehicles. Injuries have resulted to some 26 persons in these accidents, but fortunately there have been no deaths due primarily to slow train speeds prevalent within the yard limits. However, the critical deficiency of the present crossing is excessive delay and the project will eliminate that condition.

LOCATION CAREFULLY CHOSEN

The proposed underpass will be located on Washington Street which is one block south of the present crossing at Lincoln Street. Washington Street does not cross the tracks at present. By constructing the underpass at this location all traffic will benefit, and it will provide a non-delay connection between both portions of the town, which is an important factor when considering movement of units for protection of the public safety and property.

The site chosen will provide the greatest benefit for a majority of the people. The main factor taken into consideration in selecting an underpass was in providing a structure which would have a good appearance and utility without disturbing any more of the present movements of traffic than was necessary on the existing city streets.

DESCRIPTION OF STRUCTURE

The depressed portion of the structure is some 1400 feet long, from Oak Street on the south thence along Washington Street passing under the present State Highway (Vernon Street) continuing under 17 tracks of the Southern Pacific Railroad, and finally again coming to natural ground elevation at Church Street. Outer roadways will be constructed from the alley which is located between Oak and Vernon Streets to Atlantic Street, thus providing connections which will allow as many traffic movements as possible between existing streets.

Within the underpass there will be two 24-foot roadways with a 6-foot dividing strip. At the Oak Street end the entrance to the depressed portion will be an open cut, so constructed that the motorist will have a maximum of overall visiblity regardless of the direction from which he may be entering the underpass. Retaining walls of the reinforced concrete cantilever type are a standard design adopted by the Bridge Department of the State of California.

UNDERPASS BARREL 360 FEET

A reinforced concrete continuous slab structure consisting of two 31-foot spans will carry Vernon Street over the depressed portion. Vernon Street is 80 feet between property lines and the structure will be constructed to this width, which includes two 12-foot sidewalks. While the slabs have a parabolic soffit, an outer curtain beam of a uniform depth will be placed in order to carry out the general theme of straight line construc-


OAK ST

tion which is dictated by the railroad structure.

The underpass barrel directly under the tracks is some 360 feet in length and located on a 5,000-foot radius curve. Adjacent to the west roadway is a pedestrian ramp seven feet wide, which requires that the westerly roadway be a 39-foot span and the easterly one 31 feet. The deck for the 39-foot and 31-foot spans consists of 33-inch steel wide flange beams weighing 200 and 152 pounds per lineal foot respectively, spaced at 2-foot 6-inch centers, over which is placed a reinforced concrete slab four inches thick. On top of the concrete slab will be placed 1½ inches of waterproofing material, over which the ballast is placed supporting the ties and rails.

DIVIDING STRIP

The intermediate support placed within the 6-foot center dividing strip was designed for a minimum of width in order that as much clearance as possible could be attained between it and the adjacent curbs. It consists of a steel box girder four feet deep which rests on 24-inch steel wide flange columns spaced at 12-foot 6-inch centers founded on a continuous reinforced concrete footing. Within the 360-foot length of deck, three expansion joints are located transversely extending through the box girder and deck, taking care of the expansion and contraction caused by the temperature differential.

In order to utilize rolled sections and to meet the design requirements for loading it was necessary to utilize structural silicon steel for the columns. This steel has a basic working stress of 24,000 pounds per square inch as compared with 18,000 pounds per square inch for the structural carbon steel, which is being used for all other structural steel on the job. Abutments and center pier for the railroad structure are founded on reinforced concrete spread footings.

PEDESTRIAN RAMP

The aforementioned pedestrian ramp extends from Vernon Street on a down grade until it passes under the tracks in the underpass barrel adjacent to the westerly roadway and emerges at the north end with a ramp rising to natural street grade on Washington Street and a stairway which will rise to natural ground and allow pedestrians to cross the depressed portion on a reinforced concrete box girder which forms a facia beam for the north end of the barrel. This concrete box girder provides a pleasing entrance to the underpass as it spans both roadways and the pedestrian ramp thereby giving the entrance a more open appearance.

Through the barrel the level of the pedestrian ramp is some seven feet above the roadway, giving a satisfactory separation between vehicular and pedestrian travel with greater safety.

Along the tops of retaining walls and adjacent to pedestrian ramps a steel handrail will be placed, the rail will be three feet high, and consist of three horizontal hollow tubular members with round vertical posts placed at approximately 8-inch centers.

LIGHTING IS ADEQUATE

A considerable amount of thought and planning has been given to adequate lighting both within the underpass and at other strategic locations for the safety of the traveling public. There will be no dark spots within the underpass and the public will feel free to utilize the pedestrian walkway without fear. For the covered section a greater volume of light has been provided at the entrance end of each roadway, gradually diminishing as the opposite end is reached, such that a transition in light intensity will allow the motorists' eyes to properly adjust themselves in both daytime and nighttime driving. On account of the length of the barrel it will be necessary to maintain 24-hour lighting for some of the lights.

Lighting facilities in connection with the underpass will be included in the contract plans. The City of Roseville will maintain those lights in which illumination of city streets is involved.

DRAINAGE BY PUMPING

The depressed portion covers approximately two acres, all of which will be drained by pumping. A pumphouse placed behind the retaining wall will be located at the northeast corner of the intersection of the subway with Atlantic Street. In addition to surface water a small amount of subsurface water will be handled. Altogether a capacity of 1,400 gallons per minute will be discharged by two pumps into a 48-inch sanitary sewer. A storage box having a capacity of approximately 10,000 gallons will be located under the roadway adjacent to the pumphouse.

Utilization of this box allows a smaller pump capacity than would be required than if all of the water were immediately discharged, particularly during periods of intense rainfall. The box and pumps have been designed on the basis of an intensity of rainfall that would be realized once in 10 years, or putting it another way, once every 10 years as determined by rainfall records it can be assumed that the storage box will be full for a short period, since rain is falling faster than the pumps can take it away, then as the rainfall decreases below the pumping rate the storage box will gradually be emptied.

At the present time there is a 36-inch city storm drain along Washington Street, which discharges into Antelope Creek immediately south of Oak Street. Between the pumphouse and the creek a distance of about 800 feet, this line will be replaced by a 48-inch pipe to handle the additional water from the underpass pumping plant, as at present the 36-inch line is practically taxed to capacity.

Necessary Paper Work

January 7, 1947

Mr. S. V. Cortelyou
District Engineer
Division of Highways
808 State Building, Civic Center
Los Angeles 12, California

Gentlemen: How can public officials get their important work done when they feel they must reply to every petition or query of a voter with a long letter such as your very kind reply to me? Certainly, the detail and paper work is so ponderous that there is no time for thought or accomplishment of practicable objectives.

I think the voter and taxpayer who demands an explanation and voluminous reply to every protest or comment is a dope. Can appreciate your position—but wouldn't it be wonderful if you could just devote your time to doing things?

Yours very truly,
Mrs. Lewis A. Kingsley
6331 Quebec

New Directional Service for All of State's Historical Landmarks

By M. A. O'BRIEN, Maintenance Department

THE DISCOVERY of Gold in California in 1848, the Gold Rush days of 1849 and the Admission of California to the Union in 1850 will be the theme for three centennial celebrations to be held during the next three years. It is therefore fitting that special attention be given to the historical landmarks that formed an important part in our early history.

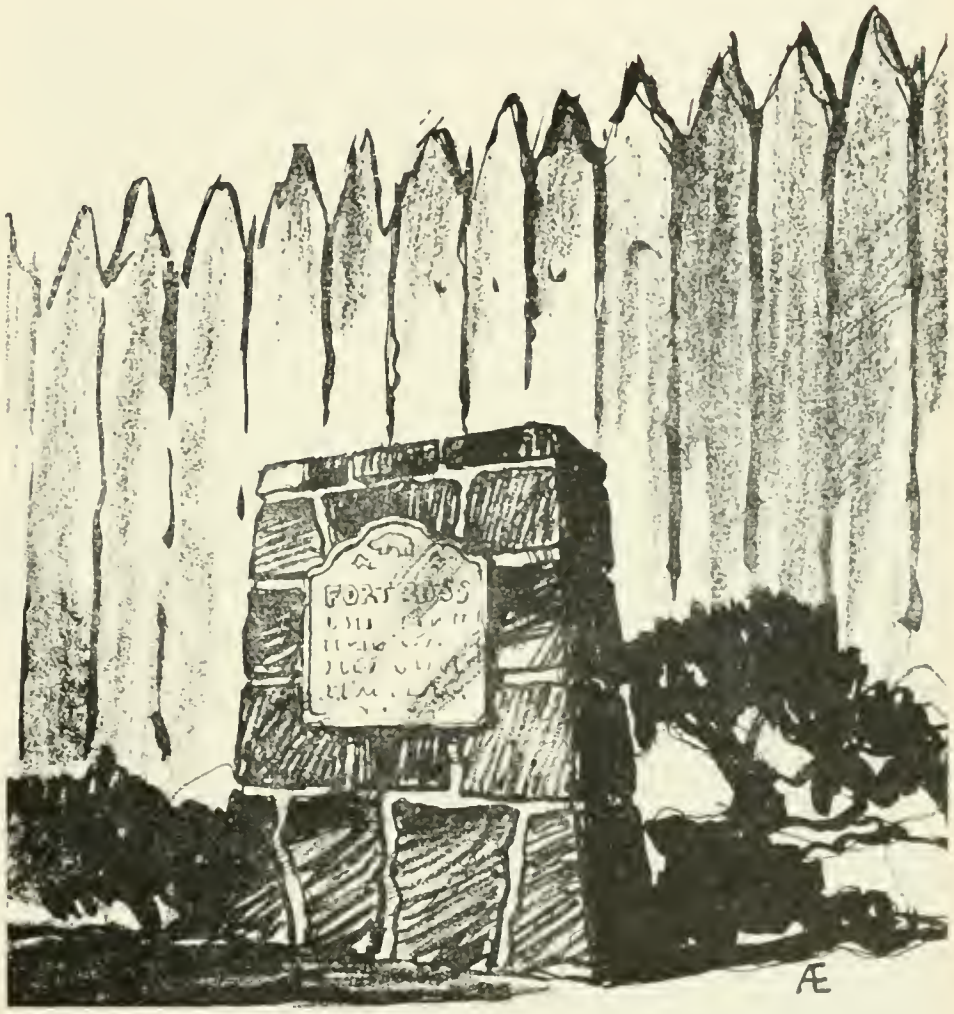
It is proposed by the Division of Highways to revamp the present method of signing and directing travel to historical landmarks. The new plan should encourage a large number of tourists to visit these landmarks as they will know in advance the historical significance of each site.

At the present time, a chocolate colored sign indicating the landmark name and number is erected at the site, when the landmark is on or adjacent to the state highway; and at the nearest road junction, if the landmark is located on a county road.

The State Chamber of Commerce, acting through its Historical Landmark Registration Committee, investigates all historical landmarks submitted for approval and its aid and cooperation were obtained in developing the new plan. This committee selected 42 of the more important historical landmarks for this special directional service, and will provide the text for the historical description.

The work to be done contemplates the construction of a parking area of turnout, which will be graded and oiled. As most of the historical landmarks selected for this special treatment are located some distance and off of the State Highway System, the parking areas will be constructed in advance of the county road intersections leading to the landmarks.

A rubble masonry monument containing a bronze plaque showing the landmark name and number, will be constructed in this parking area. The plaque will carry a 40-word description of the landmark and its historical significance. New distinctive signs having brown letters on a stucco-colored background will also be placed at the nearest intersection of the state highway and county road leading to the landmark. This new sign will also be placed at the sites, when located on state highways, in lieu of the present chocolate markers. In addition to the above signs, there will also be installed an advance sign, giving notice of "Historical Information Ahead," which will be placed approximately 500 feet in advance of the parking areas.



Artist's sketch of rubble masonry monument containing a bronze plaque bearing the landmark, name, and number

The 42 landmarks selected by the Historical Committee are located throughout the State. They have all been inspected, parking sites selected, and the work of grading the parking areas and constructing monuments will be undertaken within a short time. It is anticipated that the first project will be completed sometime in July of this year.

New Noyo River Bridge Will Permit Expansion of Commercial Fishing Port

By RALPH W. HUTCHINSON, Associate Bridge Engineer

THE CALIFORNIA Division of Highways recently learned something about fish. It learned that the United States is the world's second largest producer of fish and that 28 percent of the nation's fish came from California, where fishing is the third largest industry in the State. This education in the fishing business was the result of a recent investigation of complaints by commercial fishermen that the state highway bridge across the Noyo River, in Mendocino County, was a hindrance to navigation.

The Noyo River enters the ocean at the south edge of Fort Bragg. It provides a small cove and a navigable river channel which permits anchorage of small fishing boats. Since 1940 the Noyo River has been a growing fishing port until now it is the second in size on the coast between San Francisco and Astoria, Oregon.

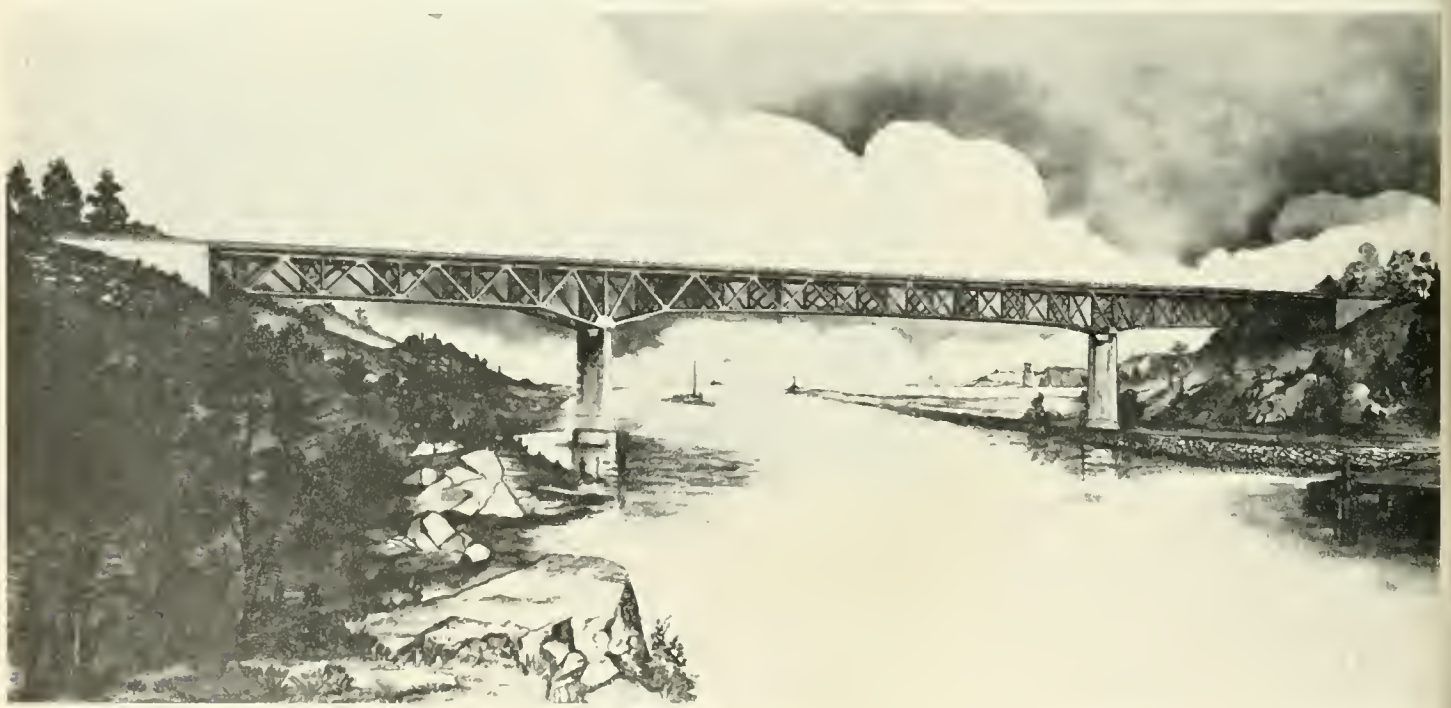
About 200 fishing boats are berthed at Noyo and about 100 more work out of the port during the favorable seasons. The annual catch is more than 7,000,000 pounds, and one of the largest fish storage plants on the coast, capable of storing a half million pounds of frozen fish, is located here.

The port facilities are greatly overcrowded and there is an urgent need for expansion. All of the present activity is confined to the channel below the state highway bridge, and expansion of the port upstream is prevented by lack of clearance under the bridge.

The existing bridge across the Noyo River was built by Mendocino County in 1927 prior to the development of the fishing industry on the river. In 1933 the bridge was taken into the State Highway System as a part of Route 56.

During 1944 the Noyo River fishermen requested the State to relocate the bridge so as to permit port expansion upstream. In spite of the merit of the request the State was reluctant to spend highway funds for the wartime replacement of the Noyo River Bridge until a definite program had been adopted for the expansion of the port. The existing bridge was estimated to have a remaining useful life of 10 years, while there were same 20 bridges on this section of State Highway Route 56 which were in more urgent need of replacement. Twelve of these bridges were restricted to less than legal highway loadings and were being maintained at considerable expense. The Office of Defense Transportation was urging the replacement of these weak bridges as a war measure.

In 1945 the United States War Department adopted a plan for the extension of the port at Noyo River and declared the existing state highway bridge to be a hindrance to navigation. In compliance with this ruling, the State agreed to replace the existing bridge within two years with a structure to provide a navigating



Design of new Noyo River Bridge is shown in this engineer's sketch of proposed span

(Continued on page 34)

Roadway Taking Shape on High Standard Highway in San Bernardino Mountains

By C. V. KANE, District Locating Engineer

GOOD construction progress is being made on the first 3.2 mile unit of the projected 15-mile City Creek Road. The high standard roadway is now taking shape on the precipitous mountain slopes, as shown by the accompanying photographs.

This highway, penetrating the San Bernardino Mountains, will be a through traffic artery for the use of the heavy summer and winter recreational traffic to the resort and playground areas at Big Bear Lake and Arrowhead Lake. It will also serve communities having an estimated 20,000 permanent population.

An alternate highway to relieve the intolerable recreational traffic overload on the present Waterman Canyon Route has been a pressing need for a number of years. Peak hour traffic volumes of 2,000 cars on weekends and holidays are a common occurrence for the existing two-lane highway constructed by the State in 1932. This volume is three times the maximum capacity considered safe by nationally accepted standards.

A feature of the design that received special consideration was the provision made at frequent intervals for overtaking and passing slower vehicles. It is accomplished by the inclusion of sections of straight alinement to afford sufficient sight distance to perform passing with safety. This is a departure from older mountain highway design where the faster vehicles often are forced to stay behind slower ones for several miles before being able to pass with safety.

Rights of way for this project are being purchased with controlled access. This method of acquisition eliminates the development of unsightly wayside stands that would create danger to traffic.

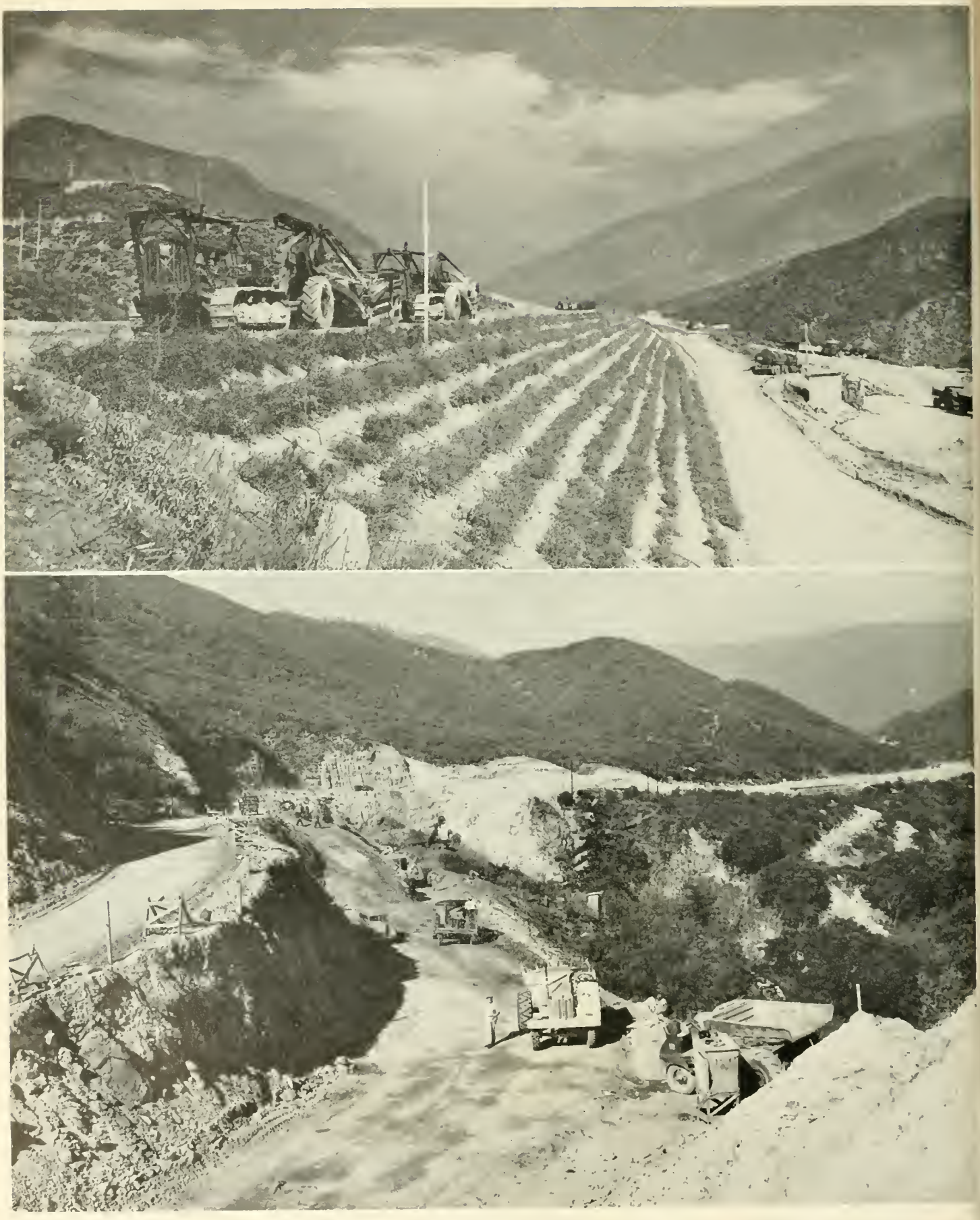
The statistical design and construction information for the current contract on this project was published in the California Public Works issue of July-August, 1946.



Above—This embankment on City Creek Road which is one-half completed will have an ultimate height of 110 feet. On opposite page, upper—Portion of 50-foot high embankment under construction, showing erosion protection features. Lower—Progressive work on sidehill excavation utilizing ramps within the roadway prism

MODERN ROADS REQUIRE HUGE VOLUME OF MATERIALS

A train of 1,480 cars would be needed to transport material used to surface 10 miles of concrete highway. To haul material for 10 miles of bituminous surfacing 720 cars are required.





Pioneering cut on Willow Pass Highway in Contra Costa County, now under construction

Construction of the Willow Pass Limited Access Freeway Under Way

By G. L. BECKWITH, Associate Highway Engineer

A SECTION of the Industrial Highway in Contra Costa County between Concord and Pittsburg and known locally as the Willow Pass Road is now under construction.

This section of state highway, taken into the State System in 1933, was designated as a county road by the Contra Costa County Board of Supervisors on March 7, 1853, and by Ordinance No. 56 it was designated as the Willow Pass Road on March 8, 1892.

The original road was a winding dirt road through the pass and received its original surfacing of an 18-foot oil macadam in 1921.

The rapid increase in traffic over this route has kept pace with the industrial growth of the Cities of Port Chicago, Pittsburg and Antioch and the growth of the agricultural areas to the east and the East Bay metropolitan area.

Due to the industrial areas as noted, a large percentage of truck traffic uses this route.

With the limited width of the old pavement, steep grades and short radii curves, it was not uncommon to find a line of traffic a half mile long following some slow moving truck through the pass. These conditions contributed to the high accident rate on this portion of the route.

The contract now under way provides for a four-lane divided highway consisting of two 23-foot Portland cement concrete pavements eight inches in thickness constructed over a cement stabilized base and divided by a six-foot division strip separating traffic in opposite directions. Eight-foot shoulders are provided to enable parked or disabled vehicles to stand clear of the paved traffic lanes.

A minimum of one foot of select material is to be placed over the grade, the upper four inches of which is to be stabilized with approximately 4 percent of Portland cement as a base for the concrete pavement.

The project is 2.6 miles in length and the new alignment reduces the curvature from 554 degrees in the old road to 133 degrees and the number of curves from 26 to 7. The maximum gradient on the old road was 9 percent which has been reduced to 7 percent on the new location.

There are 455,000 cubic yards of excavation and 5,350,000 station yards of overhaul included in the contract.

(Continued on page 10)



Alder Creek Bridge and approaches. Location of old road can be seen in left background

Replacement of Posted Bridges in District I

By C. P. SWEET, District Construction Engineer

THE TOPOGRAPHY of District I with its many creeks, rivers, and deep precipitous canyons necessitates the use of bridges in highway design to an extent not equaled elsewhere in the State.

A majority of the structures, erected both by the State and counties in early days, were of timber particularly redwood construction and designed to carry the comparatively light loads of that period. Even the few steel bridges erected were of such light design that they cannot support the heavy truck traffic using the highways today.

The posting of many of these bridges for restricted load limits pending their replacement has for many years presented to the district the problems of restrictions to free movement of traffic and high obligation of construction funds.

MANY POSTED BRIDGES

A very fitting example of this condition is on that portion of the Shoreline Highway, State Route I, between the Sonoma County Line and Westport in Mendocino County. This portion of highway originally constructed by Mendocino County and taken into the State Highway System in 1933 included, in 81 miles of roadway, over three miles of bridges, or a total of 82 structures.

Many of the bridges in 1933 were in such weakened condition that immediate posting for restricted load limits was mandatory. Fifty-five of the old structures have since 1933 been replaced or contracts are underway for erection of new bridges or replacement by culverts and fills.

While this large number has been replaced at a cost of approximately $2,500,000, a new bridge across the Noyo River near Fort Bragg, now partially under contract will cost almost a million dollars. The cost of replacing several of the remaining old structures will be in excess of one-half million dollars each, while the Shoreline Highway has presented the most critical bridge problem in the district, other bridge replacement costs have for many years obligated

a large portion of the funds allocated to the district for construction and will continue, especially on the secondary system, to do so for several years.

BRIDGE REPLACEMENTS

Restrictive controls on highway construction during the war years coupled with a marked increase in heavy truck traffic intensified the critical deficient bridge problem and funds for the first year of the Postwar Highway Program were allocated almost entirely to the replacements of several of the most critical bridges.

Three of these bridge replacement projects on State Highway 1 at Blue Slide Gulch, Alder Creek, and Slick Rock Creek have been completed or will be completed during 1947 at an estimated cost of $310,000, and will eliminate three posted bridges from the State Highway System. Their construction will also provide about 2.40 miles of graded and surfaced highway in relocated approaches.

BLUE SLIDE PROJECT

The Blue Slide project north of Fort Bragg involved the replacement of a timber bridge posted for a maximum loading of 12 tons one vehicle and 21 tons semi. The new bridge is a reinforced concrete slab type structure consisting of five 28-foot spans supported on steel piling encased in concrete and is 142 feet and 6 inches in length.

This structure is rather unique in that it does not span a stream or body of water; the purpose for which a bridge is usually built. It does however span a small deep ravine which is the outlet for a mass of moving hillside, appropriately called Blue Slide. This condition precluded the construction of an orthodox embankment.

This contract was constructed by Contractor John Burman & Sons at a cost of $69,000, and was supervised by Resident Engineer D. E. McCollum and N. E. Spicklemire of the Bridge Department.

ALDER CREEK PROJECT

North of Point Arena a dangerously obsolete wooden bridge at Alder Creek was repeatedly threatened by collapse during periods of high water. This was replaced on new alignment by a steel plate girder bridge 124 feet in length with a roadway width between curbs of 26 feet. The relocation upstream from the old structure made a 21 percent decrease in length of road and provides a safe highway at maximum speeds.

This project was constructed by Contractor Guerin Bros., under the supervision of Resident Engineer E. F. Richardson, at a cost of about $202,000.

The grading of the project was complicated by the encountering of numerous springs and water-bearing sand strata at various elevations in all roadway cuts. The control of this subsurface water was mandatory during grading operations, otherwise the material could not be readily excavated nor compacted into embankment. Bench sections designed for slide prevention were therefore extended and used to prevent water from flowing into the excavation below, when temporary ditches were maintained to collect and discharge subsurface water not intercepted by the bench sections.

Subdrainage of the wet roadway cuts below subgrade elevation was provided by a pervious gravel blanket placed on a subgrade sloping toward an underdrain or by underdrains constructed on one or both sides of the cut. Such subsurface drainage soon provided a firm and dry subgrade which when reinforced with a crushed gravel base and a bituminous treated wearing surface gives no indication to the casual motorist of the difficulties experienced by the contractor in obtaining the required result.

SLICK ROCK CREEK

About 5½ miles south of Point Arena the timber bridge at Slick Rock Creek, posted for a loading of 16 tons, was one of the district's top priority postwar replacement projects, as its critical condition prevented the free movement of farm, ocean, and forest products to the Bay Area. This contract involved the construction of two reinforced concrete arch culverts and the grading and surfacing of 1.0 mile of highway on new location at an estimated cost of $130,000. These arch culverts, 27 square feet in waterway area were constructed at Slick Rock and Morrison Creeks and were respectively 225 and 168 feet in length exclusive of wing-walls.

Though work on the contract has been suspended for the winter by Contractor Piombo Bros. and Company, traffic is now routed over the new roadway at Slick Rock Creek thereby eliminating the hazard of a failure of the posted bridge. Work on the contract was under the supervision of Resident Engineer C. C. Buckman, with the contractor being represented by Superintendent Ben R. Dow.

HIGHWAY REALIGNMENT

Relocation and construction of the northerly two miles of State Highway 29 in Lake County between Lakeport and Upper Lake west of the present highway is now underway. Two bridges, one at Scott Creek and the other at Robinson Creek, are necessitated by the relocation and will replace four posted bridges originally constructed by Lake County, over Robinson, Scott, Middle, and Clover Creeks on the existing highway.

The existing steel truss bridges across Scott and Middle Creeks were built by Lake County in 1906 and 1911, respectively, and were adequate for that period. Their light steel members, restricted widths and heights are not, however, adequate for present day traffic and both bridges are posted for one-way traffic with loads being restricted to eight tons at Scott Creek and six tons at Middle Creek. The existing bridges over Robinson and Clover Creeks are deck type structures. One is posted for one-way traffic and the other for a 16-ton load limit.

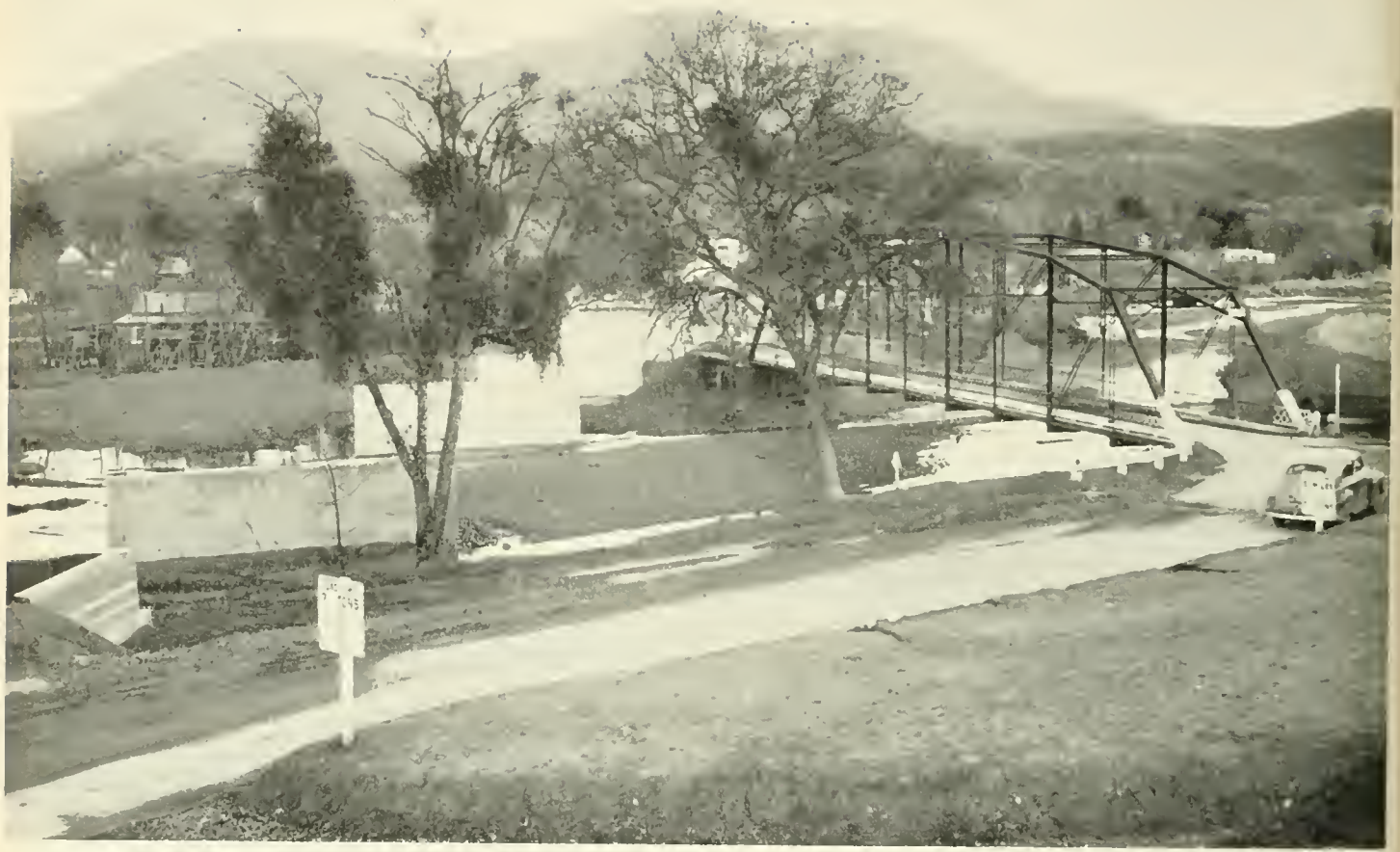
These four posted bridges constitute a definite hindrance to the movement by truck of agricultural products from the rich farming and fruit growing areas of Lake County to world markets and their replacement should provide an added stimulant to the economic life of the county.

DETOURS TEMPORARY

During the summer season state maintenance forces have annually constructed detours across Scott and Middle Creeks thereby saving trucking interests several miles of detouring over other roads to reach Lakeport. These detours, of necessity, are removed each fall and are therefore only a temporary expedient to relieve the situation caused by inadequate bridges.

Three major streams, Scott, Middle and Clover Creeks drain the mountainous northwesterly section of Lake County. Before reaching a confluence near Upper Lake they flow through

(Continued on page 35)



Upper—On left of existing posted span are shown piers for a new bridge at Kelseyville. Lower—New Blue Slide Bridge, Mendocino County



Bay Area Metropolitan Traffic Survey

THE PUBLIC Roads Administration, the Division of Highways and cities on San Francisco Bay are cooperating in a comprehensive traffic survey. The areas included in this study consist of San Francisco, Daly City, and the East Bay Territory from San Pablo to South San Leandro.

The purpose of the study is to present sound data that will permit thoroughgoing analysis of the traffic movement within the area (pedestrian traffic excepted).

A designer confronted with laying out an urban traffic facility must know the traffic that is flowing along the general line of a proposed improvement. In addition he must estimate how much will be attracted from parallel routes, and where and in what numbers vehicles on the proposed line will come into conflict with cross-traffic. In the case of freeways where the channelization of traffic is emphasized, access being permitted only at certain designated points, these problems are intensified. They are not the only traffic questions bothering the designer, for he must also be concerned with the entirely new traffic that will come into existence as a result of the improvement and with what may be termed the natural growth of traffic. These are matters upon which he has frequently been faced with an undesirable amount of speculation. Adequate enough in rural areas and on the outskirts of cities, the methods heretofore used in estimating traffic have shortcomings which become increasingly pronounced as the great cities are penetrated more deeply.



When M. R. Nickerson, Public Works Department Photographer, was taking the pictures which accompany this article, the inquisitive little dog shown in this photograph injected himself into the picture unbeknown to the cameraman and the traffic checker

ORIGIN AND DESTINATION

Although they show total use of a street, traffic counts may fail to show that the street is loaded to capacity, and that traffic has been forced to use parallel streets and to travel a circuitous course. Origin and destination studies have been used for many years on rural highways to gauge the effect of proposed improvements, particularly where a choice of routes existed. Except in special cases this method is inapplicable within cities.

During the past few years remarkable progress has been made in the improvement of city traffic studies. The method of the Bay Area Metropolitan Traffic Survey was developed by the Public Roads Administration in cooperation with the Bureau of the Census. It has been, or is being used in approximately 50 large cities. Simply stated, the method consists of interviewing a representative sample of people in their homes concerning their travel on the preceding day. Such a study through which the traffic generated by the residents of an area is determined, is referred to as an "Internal Survey."

Though the sampling idea which is the basis for the internal survey is simple, great care is necessary in putting it into practice. Every twentieth dwelling unit is selected, be it house, apartment, or hotel room. The selection is made either from a study of Sanborn maps or from field inspection in the areas not covered by maps. The residents of these dwellings are then interviewed and their travel for the preceding day is recorded from one street address to another. The mode of travel, whether as an auto driver, auto passenger or street car passenger, is noted. Other notes show the approximate time of starting and arrival and whether the trip was to work, for shopping, etc. In the case of an auto driver, the kind of parking is also obtained.

While recollection serves adequately for the home interviews, it cannot be relied upon for the trips made by trucks and taxis, many of which make as many as 50 trips daily. In such cases the sampling procedure is modified. The interviewer is furnished with the registration numbers of specific vehicles and required to contact the drivers through the owners. The proportion of trucks contacted is also increased to one in seven trucks. In many cases truck owners maintain accurate records of truck trips and these are utilized. Where no records are available, drivers are asked to maintain a simple log of their travel on the following day.

STUDY NEARING COMPLETION

The interviews at the 26,000 dwelling units in the Bay area are 71 percent complete and will be finished in



Truck drivers being interviewed on Washington Avenue near the south city limits of San Leandro on State Route 69, Alameda County

April. It appears now that the average number of trips per dwelling unit will approximate 5. The time required to complete an interview for a dwelling, including time spent in travel and in making more than one visit where necessary, is slightly less than one hour. The response from the public has been good, as is attested

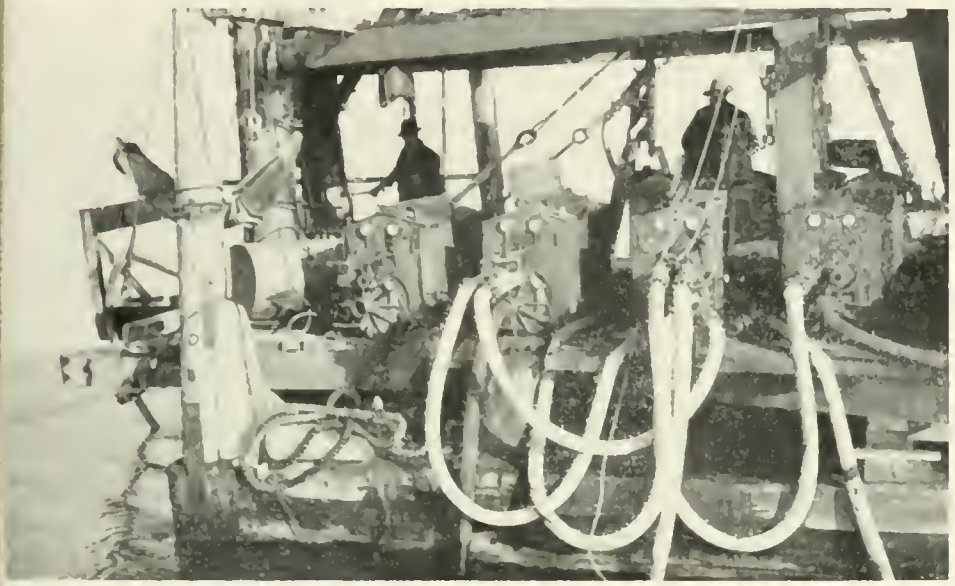
(Continued on page 36)



Interviewing drivers at External Traffic Station south of San Leandro. Note portable light standards in background

Foundation Exploration in San Francisco Bay

(Continued from page 11)



Pumps used to develop high water pressure for jetting

METHOD OF OPERATION

Samples usually were obtained by removing the goose neck from the top of the jetpipe. The sampler and tip were lowered inside of the jet pipe by means of three-fourth inch cable on one of the deck engine drums. Cable on the drum was allowed to run free, giving considerable momentum to the sampler and allowing the tip to penetrate any subsurface material except the hardest rock. If samples were desired at intermediate points before the full length section of pipe had been jetted its entire length, the sampler cap was removed from the top of the gooseneck and the same procedure was followed. The samples were classified, immediately sealed in half-pint fruit jars, and are now on file in the Public Works Building in Sacramento. Elevations of changes of subsurface strata were determined by reactions of jet, i.e., by changes in speed and force of descent, by changes in jet line pressure gauge readings, by feel of the pipe as it jounced, and by the ring of the pipe when on extremely hard strata. A total of 143 samples were obtained from the 40 jet borings.

DIFFICLTIES ENCOUNTERED

Many difficulties were encountered during the progress of the preliminary foundation investigation which handicapped progress, but did not cause serious set-backs.

Due to the narrowness of the barge in relation to the height of the leads, winds of any particular magnitude created the most serious difficulties encountered during the jetting operations. This was particularly true if the wind caught the barge broadside. This width to height ratio created a strong rocking motion which was magnified at any height on the leads and made the addition of jet pipe difficult. South east winds of gale intensity accounted for four days lost time and predictions of high winds which failed to materialize accounted for two lost days.

Next in severity to the wind but for short duration were broadside swells caused by passing ships and ferry boats. The side wheel ferries created the largest swells.

Heavy fogs added to the difficulty of locating the barge by obscuring the landmarks and accounted for six lost days. On several foggy days it was possible to work at a location close enough to shore or the existing Bay Bridge to be able to begin work without the necessity of sights. After the fog cleared bearings were taken and the exact position plotted.

Due to the various maritime strikes at the time of the jet boring operations, numerous ships were riding at anchorages in the Bay. Consequently, it was necessary in some instances to move the location of a boring in order to clear the sweep of a ship as it turned at anchor with the wind or tide.

The presence of submarine cables caused delay and loss of time in anchoring and spotting the barge but otherwise created no serious difficulties.

The results of the borings together with other pertinent considerations and investigations are being assembled in a special report to be submitted to the California Toll Bridge Authority.

Facts About Second Bridge Over S. F. Bay

(Continued from page 5)

Q. Are these methods satisfactory?

A. The Southern Pacific would gain no advantage for the bulk of its traffic through a crossing farther north than its present one. The other two railroads might save a little in operating costs by operating over tracks but not nearly enough to justify the investment required. The present ferries having handled the war traffic are ample for normal business.

Q. How are passengers from the trains taken across the bay now?

A. Southern and Western Pacific passengers are transported by ferry, Santa Fe passengers by bus across the Bay Bridge.

Q. Can any savings in time be gained by transporting passengers over a bridge via Hunter Point?

A. The time required to reach a terminal at Townsend Street would be longer than now required to cross the bay and the location of this terminal is more remote from the center of traffic than either the Ferry Building or the bus station at Fourth and Mission Streets.

Twelve Miles of U. S. 40 Converted To Four-Lane Divided Highway

By M. C. FOSGATE, District Construction Engineer

THE FIRST two postwar projects to be completed in District X were opened to traffic at 4.00 p.m. January 27, 1947.

These two projects are adjacent and have a combined length of 12.15 miles and extend from Vacaville to 1.3 miles north of Dixon on U. S. 40. The first project which is 6.02 miles in length extends from Vacaville, northerly, to Midway, and provided for the construction of two lanes of Portland cement concrete pavement having a total width of 23 feet which parallels the existing highway making this section a four-lane divided highway, with the new pavement on the easterly side of the existing highway.

The second project which extends from Midway to 1.3 miles north of Dixon is located on new alignment, and therefore it was necessary to construct four lanes of pavement to complete the divided highway.

The new work consisted of Portland cement concrete pavement throughout placed on a gravel base. The lanes are separated by a uniform dividing strip 36 feet wide from Midway to 1.3 miles north of Dixon. The section from Vacaville to Midway has a varying width of dividing strip caused by natural barriers. This dividing strip has a 12-foot width on the south end where the construction is located through a large cut, and attains its greatest width, which is 136 feet, where Horse Creek and Gibson Canyon Creek are carried for some distance between the two lanes. These channels required some straightening and riprap protection where they were turned to cross the highway under two new bridges.

The design of the concrete pavement on these projects was a departure from the Standard concrete construction which had been employed in California for many years. Prior to this time, the standard design of concrete pavement had thickened edges at each side of each lane and expansion joints placed at varying distances, the average of which would probably be 75 feet.



Looking northerly from the point of starting of the new four-lane divided highway near Vacaville



This photograph was taken north of Midway looking toward Dixon and shows bridge units of project

Between these expansion joints, contraction joints were constructed at intervals of 15 feet or 20 feet; these intervals varying under different native climatic conditions. These contraction joints were constructed by inserting a mental strip transversely in the concrete while it was fresh. These metal strips were ¼ inch x 1½ inches in cross-section and slightly beveled and extended the full width of the pavement lane. When the concrete became partially set, the strips were removed, the resulting space left open and the edges tooled. This caused a weakened plane to be established at this location so that when the concrete contracted, the crack would be carried down to the subgrade along this weakened plane. This method of construction controls cracking and facilitates the maintenance of the pavement by making it possible for the maintenance crews to readily fill these openings with asphalt and thereby eliminate water from rainfall from entering into the subgrade.

The design of the pavement on these projects was an an 8-inch slab without thickened edges, and with contraction joints placed at intervals of 15 feet throughout. There were no expansion joints placed in this pavement, the pavement thereby becoming a continuous slab throughout by the placing of tie bolt assemblies whenever the placing of concrete in the pavement was stopped for any reason whatsoever. This concrete was placed in two adjacent lanes, the driving lane being 11 feet wide and the passing lane 12 feet wide. These two slabs were tied together by tie bolt assemblies. These bolts are ¾ inch in diameter and extend into each slab for a 15-inch distance. The bolts are placed 30 inches apart. This eliminated the tendency of the slabs separating at the joints. In addition to this, a tongue and groove joint is provided between the slabs. This joint is a protection against the possibility of one slab raising above the other at the joint.

Further design features on this project are 2-foot plant-mix borders adjacent to the passing lane and 3-foot plant-mix borders adjacent to the driving lane. The shoulders on the passing lane are 5 feet in total width, and on the driving lane 8 feet in total width. The area outside of the plant-mix borders has received a penetration oil treatment.

Crossovers are placed at strategic points and at intersecting county roads. At the county roads, most of which intersected the highway at quite severe angles, these intersections were redesigned so that the traffic would meet the highway at right angles. Curbs, and in some places, traffic bars have been placed, in order to control the crossing movements.

As these projects are both limited freeways, all entrances to this highway are controlled. The rights of egress and ingress are limited to designated openings, and no other approaches than at these locations are permitted. Places of business, such as service stations and at roadside eating places, curbs are

(Continued on page 39)

Erection of Signs and Notices Designating California Freeways

By H. L. COOPER, Assistant Maintenance Engineer

FOR MANY years, the only available means of controlling the use and development of lands abutting State highways in California was through the enactment of zoning and setback ordinances by the city and county officials within whose respective territories the state highway was located.

As the volume of traffic using the state highways continued to increase year by year, it became evident to state highway officials that measures would have to be taken to protect the large investment which the State had in these roads in order to insure their integrity and serviceability. It was apparent that this could only be accomplished through some legal control of the right of way which would make it possible to regulate the movement of traffic.

In recognition of this need, the Legislature in 1939 enacted the Freeway Law, which placed California in the small group of states first to apply the principle of controlled access to highways. This law, as set forth in Section 23.5 of the Streets and Highways Code, defined a freeway as "a highway in respect to which the owners of abutting lands have no rights or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access." It authorized the department to designate certain routes as freeways, to acquire the necessary rights of way and rights of access from private property, and to construct and maintain such freeways.

Illustration A



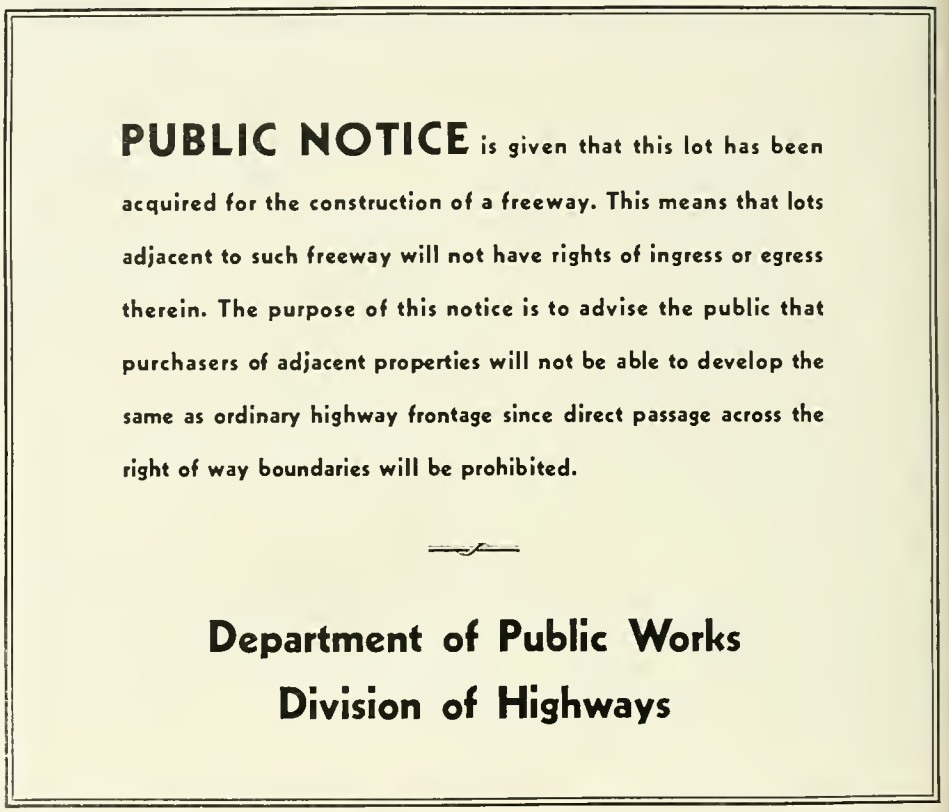


Illustration B

Since the enactment of the Freeway Law, the California Highway Commission has adopted resolutions declaring 714 miles of the State Highway Systems freeways as of January 1, 1947. Of these, 175 miles have been constructed.

The application of the freeway principle to the utility services and owners or purchasers of abutting property has posed many new problems for the division. The utilities in particular were not inclined to relinquish the privileged locations they normally enjoyed within highway rights of way. The policy governing encroachments affecting this group was adopted by the division only after numerous and extended hearings wherein representatives of both the private and public utilities were afforded ample opportunity to discuss and present their views.

While the division realized the importance of likewise defining the limitations of access applying to property abutting freeways, it also appreciated the practical difficulties of accomplishing this purpose in the face of changing ownership and property development. It was finally decided to define this status through the medium of special signs and, further, to mark the definite limits of such access with concrete monuments.

Following is a brief description of each type of marker, their design, and the conditions governing their placement:

On freeways in rural areas, signs similar to **Illustration A** will be placed facing the highway at one-quarter mile intervals along the abutting property adjacent and parallel to the right of way line. Similar treatment will be

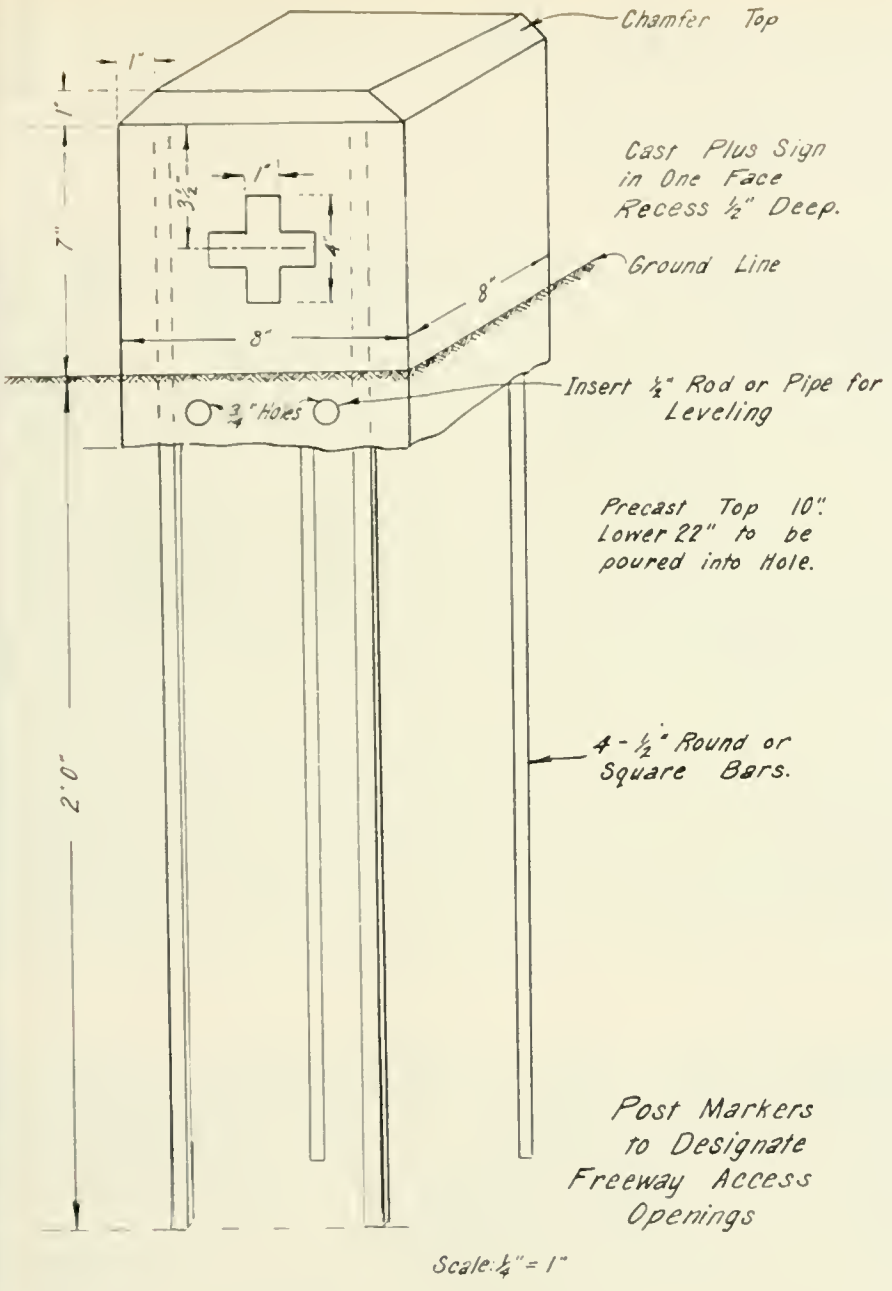


Illustration C

accorded freeways in urban areas where the right of way is not fenced.

A special sign made of 10-inch x 12-inch cloth mounted on wood and supported by 2-inch x 2-inch x 4-foot wooden posts similar to **Illustration B** will be used at locations where the acquisition of right of way has taken one tier of lots of the abutting frontage and the right of way line is along the lot line of the next tier of the adjoining parcel of property. This type of sign will be installed adjacent to the right of way line and in front of each lot of such abutting parcel.

On freeways where the abutting property has a limited access right, the outer boundaries of such access openings will be marked by concrete monuments similar in design to **Illustration C.** These marker posts will be located within the highway right of way immediately adjacent to the right of way line at the outside limits of the access opening, with a plus (—) sign on the monument facing the space included in the permitted access opening. Where access openings on adjoining properties are contiguous, but one monument will be set on each property marking the outer limits of the respective openings.

This system of signing should serve to acquaint the public as to the highway's freeway status and avoid any misunderstanding of the access rights vested in such abutting property. The concrete marker posts will also prove a ready aid to our maintenance men in observing conformance with the permitted access openings.

In Memoriam

Francis G. Somner

Francis G. Somner, one of the first district engineers of the Division of Highways, passed away on February 5, 1947.

Mr. Somner was born in Dunedin, New Zealand, on August 10, 1863. His father, a building contractor brought his family to California when the son was 10 years old, and settled in Plumas County. Mr. Somner attended school in Quincy, and took an engineering course at the University of California. He was a classmate in 1888 of Governor Hiram Johnson. Returning to Quincy, Mr. Somner married Mary Cate, a native daughter. He was County Surveyor of Plumas County in the early nineties. He was roadmaster for the Southern Pacific, Shasta Line from 1895 to 1905. Afterwards he was Chief Engineer of the Diamond Match Company at Chico.

On January 1, 1912, he began his highway service under the first State Highway Engineer, A. B. Fletcher, in charge of Division I (now district), with headquarters at Willits. Mr. Somner had charge of locating and constructing the state highway through the Redwood Empire from Cloverdale north to the Oregon line. During the early days of reconnaisance in the primeval forest, the activities were largely carried on by foot, horseback, mudsled and oxteam. In 1923 Mr. Somner was transferred to Bishop, in charge of Highway District IX, where he built roads from Mojave East of the Sierra to the Nevada line. He blazed a trail through forest, mountain and desert that may well be appreciated in the development of California.

Mr. Somner was a life member of the Masonic Lodge at Red Bluff. He retired from state service in June, 1932, and has been living ever since in San Francisco. He is survived by his widow, Mary, a daughter, Mrs. E. Y. Himmilwright of San Francisco, a daughter, Mrs. Philip Piltz of Stockton, and a son, Frank, of Los Angeles.

The oldtimers of the "Highway" will long remember Mr. Somner for his outstanding work, and his genial acceptance of jokes and incidents on himself that helped to smoothen the rough profile of the "Roadway of Life."

Serious Bottleneck on U. S. 101 South of Salinas Is Eliminated

By G. H. HAMLIN, Resident Engineer

THE RECENTLY completed four-lane section of U. S. 101, State Route 2, extending two miles south from the south city limits of Salinas has eliminated a serious bottleneck on the Coast Route.

As originally planned, the contract was to have been let in 1942, but outbreak of the war forced a change in these plans, so the work was held over and made one of the first postwar projects.

The enormous production of lettuce and vegetables in the Salinas area is reflected in a very heavy produce truck movement, the peak of this traffic occurring during the summer months when tourist traffic is at its height.

Some idea of the traffic volume of the section of U. S. 101 immediately south of Salinas can be gained by reference to the July, 1946, traffic count, which shows a 16-hour total of 11,291 vehicles, with an hourly peak of 1,051 vehicles. The problem is further aggravated by an intense development of packing sheds and other industrial establishments in the area, creating a considerable volume of intersecting traffic, especially severe at the beginning and ending of work shifts. An additional hazard is the grade crossing of the Southern Pacific's Spreckels branch line, over which a considerable number of slow speed train movements are made each day.

CONGESTION RELIEVED

The relief of these congested conditions was brought about by the construction of a divided, four-lane highway providing two lanes of 12-foot and 11-foot width on each side of the concrete curbs of the central dividing strip, and providing eight-foot wide shoulders on both outer edges.



Widening of division strip at county road intersection



Curved division strip with acceleration lane provided for future county road intersection

The existing 20-foot asphalt concrete pavement was utilized as a base for new surfacing through the greater part of the job. Insofar as was practical, this pavement was used to carry traffic through the job while work on the new lanes was in progress, thus creating the least possible delay and inconvenience to the public.

Roadway excavation was a relatively minor item and consisted mainly of excavating along the edges of the existing asphalt concrete pavement and under the new roadway section to provide sufficient depth for the imported borrow. The limited area to be excavated, the excess of excavation over embankment, and the necessity for keeping traffic interference to a minimum, made it necessary to handle practically all excavation with a dragline and trucks.

TRAFFIC NOT INCONVENIENCED

The use of the familiar tractors and scrapers was limited to the minor roles of removing topsoil and balancing out small quantities of material within the excavated sections. Excavation, as with other items of the work, was accomplished with a minimum of inconvenience to the traffic entering or leaving the numerous commercial establishments and intersecting roads along the route.

Due to low terrain and poor bearing ratio of soils, the area under traffic lanes and shoulders was covered with a minimum of one foot of imported borrow. As planned, traffic lanes consisted of seven inches of cement treated base surfaced with three inches of asphalt concrete, and shoulders were surfaced with plant-mixed surfacing over the imported borrow. Because of excessive ravelling of the cement treated base under heavy traffic prior to surfacing, it was necessary to modify the plans slightly and cover the cement treated base with a one-half-inch blanket of plant-mixed surfacing. This expedient eliminated all ravelling and provided an excellent base for laying asphaltic concrete.

CEMENT TREATED BASE

Cement treated base was produced by the contractor on the job through a commercial concrete batching plant equipped with a pug mill. The excellent control of materials through this plant in conjunction with its location at the midpoint of the job provided a very minimum of hauling time, permitting ample leeway for spreading and compacting the material within the specified time limit.

Both plant-mixed surfacing and asphalt concrete were mixed at Central Supply Company's Aromas plant and hauled to the job in covered trucks, a distance of 20 miles. Just prior to the commencement of paving operations, the contractor purchased a new Barber-Greene paver which was utilized in paving operations for both leveling and surface courses, except the thin protective layer of plant-

mixed surfacing over the cement treated base. The machine was also successfully used in laying road approaches with returns as sharp as 20-foot radius.

GRADE CONTROLS

One of the major difficulties encountered in paving was that of establishing and maintaining grade controls at the centers and outer edges of the traffic lanes. Grade at inner edges was established by the curbs and gutters, and provided control at this point only so prior to the start of cement treated base, a device was worked out to make use of this one control point. This consisted of a 12-foot straight edge to which an ordinary carpenter's level was fastened, pivoted at one end, and adjustable at the other by means of a bolt and wing nut under spring tension. The movable end of the level was provided with an indicator which was calibrated accurately for slopes to the nearest one-fourth of 1 percent. The required slope was set on this device for any given station and the grade carried outward from the gutter to the required width. This device was in continuous use on cement treated base, plant-mixed surfacing, and asphalt concrete, and proved sufficiently accurate to control grades within the allowable tolerances.

MAJOR CONTRACT ITEMS

Major contract items involve the following quantities:

Roadway excavation		29,500 cu. yd.
Imported borrow		24 000 cu. yd.
Plant-mix surfacing		5,600 tons
Cement treated base	aggregate	13,500 tons
	cement	4,300 bbls.
Asphalt concrete		7,350 tons
Portland cement concrete (curbs and gutters)		590 cu. yd.

The completion of the project has resulted in a marked improvement in the flow of traffic through the area. The channelization and control of traffic by separation of opposing lanes, and the control of intersecting traffic through the strategic location of dividing strip openings, has materially reduced delay and hazard to traffic. Improvement has also been effected at the grade crossing of the Southern Pacific's Spreckels branch, reducing the distance to which traffic piles up when stopped by train movements.

The improvement was let as one contract to Granite Construction Company of Watsonville, and the total cost was approximately $210,000. The contractor's forces were under the supervision of Superintendent William E. Cowan. Resident engineers for the State were L. L. Funk and G. H. Hamlin, Mr. C. E. Waite, District Construction Engineer and Mr. L. H. Gibson, District Engineer.



Raised bars in central division strip on transmission from two-lane to four-lane divided highway

Highway Bids and Contract Awards for December, 1946 and January, 1947

December 1946

ALAMEDA COUNTY—At Fruitvale Avenue, in the City of Oakland, the substructure for an overhead structure over the tracks of the Southern Pacific Railroad to be constructed, and a portion of outer highway to be constructed. District IV, Route 69, Fredrickson and Watson Construction Co. and Lew Jones Construction Co., Oakland, $390,611; Johnson Western Company, Alameda, $398,296; Dan Caputo and Edward Keeble, San Jose, $427,799; Guy F. Atkinson Co., South San Francisco, $436,767; M & K Corp., San Francisco, $439,650; A. Soda & Son, Oakland, $500,596. Contract awarded to S. J. Amoroso Construction Co., San Francisco, $387,032.

ALAMEDA COUNTY—On East 14th Street between Plaza Drive and 158th Avenue, a reinforced concrete box culvert to be constructed. District IV, Route 105, Section B, J. R. Armstrong, El Cerrito, $10,883; Evans Construction Co., Berkeley, $11,366; Gallagher & Burk, Oakland, $11,828; Willis F. Lynn, Berkeley, $11,930; Kiss Crane Co., San Pablo, $11,990; McGuire & Hester, Oakland, $12,916; R. N. Murdock, Oakland, $13,010; N. M. Ball Sons, Berkeley, $13,813. Contract awarded to Wheeler Construction Co., Oakland, $10,506.

KERN AND TULARE COUNTIES—Between Poso Creek and Ducor, about 18.3 miles to be graded, imported borrow placed and bituminous surface treatment applied. District VI, Route 129, Sections AB, A. Westbrook and Pope, Sacramento, $298,176; N. M. Ball Sons, Berkeley, $298,775; Geo. E. France, Visalia, $305,572; Clyde W. Wood, Inc., North Hollywood, $309,026; Fredrickson & Watson Construction Co., Oakland, $322,985; George von KleinSmid, Bakersfield, $329,867; Guy F. Atkinson Co., South San Francisco, $339,891; J. E. Haddock, Ltd., Pasadena, $354,071; Griffith Co., Los Angeles, $356,851; Rexroth & Rexroth, Bakersfield, $359,917; Ted F. Bann, Fresno, $375,935; M.J.B. Construction Co., Stockton, $381,351; John M. Ferry, Glendale, $387,197; Heuser & Garnett, Glendale, $393,318; A. R. McEwen & C. M. Syar, Willits, $402,608; Arthur A. Johnson, Laguna Beach, $409,952; Dimmitt & Taylor, Los Angeles, $571,442. Contract awarded to Rand Construction Co., Bakersfield, $297,975.

KERN COUNTY—Between Keene and Tehachapi, one concrete bridge and subtsructures for four bridges are to be constructed and about 10.2 miles to be graded and bituminous surface treatment. District VI, Route 58, Sections E., F., Thpi, N. M. Ball Sons, Berkeley, $1,173,519; Winston Bros. Co., Los Angeles, $1,212,284; Bressi & Bevanda Constructors, Inc., Los Angeles, $1,239,881; Morrison Knudsen Company, Inc., Los Angeles, $1,295,889; A. Teichert & Son, Inc., Sacramento, $1,299,277; Clyde W. Wood, Inc., North Hollywood, $1,368,678; Vinnell Co., Alhambra, $1,530,121; Haddock-Engineers, Ltd., Oceanside, $1,573,128. Contract awarded to Guy F. Atkinson Co., South San Francisco, $1,096,600.

LOS ANGELES AND ORANGE COUNTIES—At intersection of Firestone Boulevard, with Paramount Boulevard, Downey Avenue, and San Antonio Drive, and at an intersection of Manchester Boulevard and Grand Avenue, traffic signal systems and intersection illumination to be furnished and installed. District VII, Routes 170, 171, 174. Sections BA, AB. C. D. Draucker Co., Los Angeles, $44,440. Contract awarded to Econolite Corp., Los Angeles, $43,311.

LOS ANGELES COUNTY—On Hollywood Parkway at Grand Avenue in the City of Los Angeles, a reinforced concrete box girder overcrossing to be constructed. District VII, Route 2, Byerts & Dunn, Los Angeles, $236,321; Contracting Engineers Co., Los Angeles, $239,717; Guy F. Atkinson Co., Long Beach, $243,809; Haddock Co., Pasadena, $247,711; E. W. Elliott Construction Construction Co., San Francisco, $257,457; E. B. Bishop, Orland, $301,251. Contract awarded to Oberg Bros., Inglewood, $225,667.

LOS ANGELES COUNTY—At 11 intersections on Garvey Avenue between Atlantic Avenue and Del Mar Ave., traffic signal systems to be furnished and installed. District VII, Route 26, Section Mon P.A. Robert E. Ziebarth, Long Beach, $11,140; Econolite Corp., Los Angeles, $42,609. Contract awarded to C. D. Draucker Co., Los Angeles, $40,365.

LOS ANGELES COUNTY—On Santa Ana Parkway at Lorena Street in the City of Los Angeles, a reinforced concrete box girder overcrossing to be constructed. District VII, Route 2, Oberg & Cook, Los Angeles, $147,922; E. B. Bishop, Orland, $148,146; Haddock Co., Pasadena, $150,193; Oberg Bros., Inglewood, $153,063; The Contracting Engineers Co., Los Angeles, $162,676; Byerts & Dunn, Los Angeles, $166,007; Guy F. Atkinson Co., Long Beach, $166,650. Contract awarded to W. J. Disteli, Los Angeles, $140,733.

LOS ANGELES COUNTY—About 13 miles south of Santa Monica, the existing bridge across Ballona Creek to be cleaned and protective coating applied. District VII, Route 60, Section C. L. H. Clawson Co., Los Angeles, $13,500. Contract awarded to Angelus Waterproofing & Paint Co., Los Angeles, $12,720.

LOS ANGELES COUNTY—About ½ mile north of Palmdale, about 0.8 mile, to be graded and surfaced with plant-mixed surfacing on cement treated base. District VII, Route 23, Sections E, F, John M. Ferry, Glendale, $56,915; Cox Bros. Construction Co., Stanton, $68,229; R. R. Hensler, Glendale, $69,953; Clyde W. Wood, Inc., North Hollywood, $72,119. Contract awarded to A. A. Edmonson, Glendale, $51,528.

LOS ANGELES COUNTY—On Santa Ana Parkway, at Esperanza Street and at Indiana Street in the city of Los Angeles, a reinforced concrete box girder overcrossing and a reinforced concrete box girder undercrossing to be constructed. District VII, Route 2, E. B. Bishop, Orland, $275,439; Guy F. Atkinson Co., Long Beach, $295,631; The Contracting Engineers Co., Los Angeles, $298,617; Winston Bros. Co., Los Angeles, $315,694. Contract awarded to Haddock Co., Pasadena, $259,141.

ORANGE COUNTY—On Harbor Boulevard between Wilson Street in Costa Mesa and Manchester Avenue south of Anaheim, about 11.2 miles to be widened and surfaced with plant-mixed surfacing and bituminous surface treatment to be applied to shoulders. District VII, Route 742. Arthur A. Johnson, Laguna Beach, $265,238; Sully Miller Contracting Co., Long Beach, $268,873; Vido Kovacevich Co., South Gate, $285,388; Cox Bros. Construction Co., Stanton, $309,747. Contract awarded to Griffith Co., Los Angeles, $241,258.

SANTA BARBARA COUNTY—At Hollister Wye between Santa Barbara and Goleta, a traffic signal system and illuminating devices to be furnished and installed. District V, Route 2, Section P. C. D. Draucker Co., Los Angeles, $23,933; Econolite Corp., Los Angeles, $35,000. Contract awarded to L. H. Leonardi Electrical Construction Co., San Rafael, $17,172.

SANTA CLARA COUNTY—On Stevens Creek Road, between Orange Avenue and Stevens Creek, about 0.4 mile to be graded and paved with Asphalt concrete and Portland cement concrete and a bridge to be widened. District IV, Route 1000, N. M. Ball Sons, Berkeley, $68,861; Eaton & Smith, San Francisco, $79,051; Peter Sorenson, Redwood City, $82,388; Johnson, Drake & Piper, Inc., Oakland, $89,933. Contract awarded to Dan Caputo & Edward Keeble, San Jose $58,785.

VENTURA COUNTY—On Las Posas Road, between U. S. 101 and Somis Road, about 4.3 miles to be surfaced with plant-mixed surfacing on existing surfacing and on imported borrow and portions to be graded. District VII, Route 877. Jesse S. Smith, Glendale, $82,120; J. E. Haddock, Ltd., Pasadena, $82,961; Fairey Hammond, Inc., San Francisco, $89,736; Dimmitt & Taylor, Los Angeles, $105,999. Contract awarded to MacDonald & Kruse, Inc., Glendale, $76,801.

January 1947

FRESNO COUNTY—Across Kings Slough about 2.7 miles south of Mendota, the existing bridge to be reconstructed. District VI, Route 41, Section P, Rexroth & Rexroth, Bakersfield, $21,800. Contract awarded to Lord & Bishop, Sacramento, $17,600.

IMPERIAL COUNTY—In the City of El Centro on 4th Street and Adams Avenue between Main Street and Imperial Avenue, about 1.2 miles, to be graded and paved with Portland cement concrete and plant-mixed surfacing. District XI, Route 26, Section E, Cn. Basich Bros. Construction Co. & Basich Bros., Alhambra, $346,230; Haddock-Engineers, Ltd., Oceanside, $387,941. Contract awarded to R. E. Hazard Contracting Co., San Diego, $317,620.

KERN COUNTY—Between 12 miles east of Mojave and Muroc Junction, about 5 miles to be graded and plant-mixed surfacing to be placed. District IX, Route 58, Section A, John M. Ferry, Glendale, $159,378; George E. France, Visalia, $164,048; Frank T. Hickey, Inc., Los Angeles, $165,619; Fairey-Hammond, Inc. & R. A. Farish, San Francisco, $169,361; Clements & Co., Hayward, $176,179; Dimmitt & Taylor, Los Angeles, $181,015; A. H. Famularo and A. A. Edmondson, Glendale, $189,155; George Herz & Co., San Bernardino, $203,035; Haddock Engineers, Ltd., Oceanside, $210,683; Griffith Company, Los Angeles, $217,131. Contract awarded to Basich Bros. Construction Co. & Basich Bros., Alhambra, $143,373.

LOS ANGELES COUNTY—At intersection of Colorado Street with Kinnelon Avenue, Madre Street, Lotus Avenue and Rosemead Blvd. and at the intersection of Foothill Blvd. and Azusa Ave., traffic signal systems and intersection illumination to be furnished and installed. District VII, Routes 161, 168, 9, 62. C. D. Draucker Co., Los Angeles, $36,491. Contract awarded to Econolite Corp., Los Angeles, $35,268.

LOS ANGELES COUNTY—On Santa Ana Parkway at Olympic Parkway in the city of Los Angeles, a reinforced concrete

undercrossing to be constructed. District VII, Route 2. E. B. Bishop, Orland, $328,259; Byerts & Dunn, Los Angeles, $341,062; Guy F. Atkinson Co., Long Beach, $347,345; The Contracting Engineers Co., Los Angeles, $349,362; Carlo Bongiovanni, Hollywood, $353,773; Winston Bros. Co., Los Angeles, $360,339; Vinnell Co., Alhambra, $383,757. Contract awarded to Haddock Co., Pasadena, $317,090.

LOS ANGELES COUNTY—At 13 intersections on Atlantic Ave., between Firestone Blvd. and Fifty-Second Street, traffic signal systems to be furnished and installed. District VII, Route 167. Econolite Corp., Los Angeles, $51,589; C. D. Draucker Co., Los Angeles, $56,558. Contract awarded to R. E. Ziebarth, Long Beach, $48,075.

LOS ANGELES COUNTY—On Arroyo Seco Parkway at Sunset Blvd. in the city of Los Angeles, a reinforced concrete box girder overcrossing to be constructed. District VII, Route 165. E. B. Bishop, Orland, $556,427; Contracting Engineers Co., Los Angeles, $585,170; Carlo Bongiovanni Construction Co., Los Angeles, $595,568; Haddock Co., Pasadena, $599,268; Guy F. Atkinson Co., Long Beach, $634,169; Peter Kiewit Sons Co., Arcadia, $712,054. Contract awarded to Winston Bros. Co., Los Angeles, $485,769.

LOS ANGELES COUNTY—At 7 intersections on Firestone Blvd. between Hooper Avenue and Santa Fe Avenue, traffic signal systems to be furnished and installed. District VII, Route 174, Section B. Econolite Corp., Los Angeles, $22,131; C. D. Draucker Co., Los Angeles, $23,200. Contract awarded to Prescott Electric & Mfg. Co., Los Angeles, $19,500.

ORANGE COUNTY—Between one mile north of Doheny Park and San Juan Creek, about 0.9 mile, to be graded and paved with Portland cement concrete on cement treated subgrade. District VII, Route 2, Section A. O'Brien & Bell Construction Co., Santa Ana, $109,945; Clyde W. Wood, Inc., North Hollywood, $117,060; A. H. Famularo & A. A. Edmondson, Santa Ana, $125,346; N. M. Ball Sons, Los Angeles, $133,400; Chas. J. Dorfman, Los Angeles, $147,902. Contract awarded to Cox Bros. Construction Co., Stanton, $106,362.

ORANGE COUNTY—Between Laguna Beach and Dana Point, about 4.9 miles, to be graded and surfaced with plant-mixed surfacing. District VII, Route 60. A. F. Heinze & John J. Swigart Co., Alhambra, $257,272; Warren Southwest, Inc., Los Angeles, $269,815; Basich Bros. Construction Co. & Basich Bros., Alhambra, $270,225; John M. Ferry, Glendale, $273,573; Griffith Company, Los Angeles, $279,250. Contract awarded to Cox Bros. Construction Co., Stanton, $256,060.

SAN JOAQUIN COUNTY—Across San Joaquin River at Mossdale, the substructure for a bridge to be constructed. District X, Route 5, Section B. Macco Corporation, Clearwater, $275,103; Healy Tibbitts Construction Co., San Francisco, $288,467; Guy F. Atkinson Co., South San Francisco, $310,561; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $326,424; H. F. Lauritzen, Pittsburg, $329,060; Johnson Western Co., Alameda, $359,791; Stolte Inc. & The Daneanson Harrelson Company, San Francisco, $367,504. Contract awarded to Lord & Bishop, Sacramento, $248,606.

TUOLUMNE COUNTY—In the City of Sonora, on Stockton Street, between Solinsky Street and Washington Street, about 0.4 mile, to be graded and surfaced with plant-mixed surfacing. District X, Route 13. Fairey-Hammond, Inc., San Francisco, $77,884; Folsom & Drollinger, Sacramento, $84,570; Louis Biasotti & Son, Stockton, $91,474; J. Henry Harris, Berkeley, $108,396. Contract awarded to Beerman & Jones, Sonora, $74,716.

Two Highway Commissioners Reappointed

TWO MEMBERS of the California Highway Commission, Homer P. Brown of Placerville and C. Arnholt Smith of San Diego, were reappointed by Govern Earl Warren on January 31st for four-year terms ending January 15, 1951. Both have been members of the commission since September, 1943.

Mr. Brown became a resident of El Dorado County during the early part of 1927 and constructed the plant known as the Diamond Springs Lime Company, which he owns and operates in the manufacture of lime products.

He was born in Butte County, July 4, 1878, and before going to El Dorado County was engaged in the sugar industry for 21 years. He is a member of the Sutter Club of Sacramento and the Bohemian Club of San Francisco.

Mr. Smith is one of the leading bankers of Southern California. He is President of the Clearing House Association of San Diego, Vice President and Chairman of the Board of the United States National Bank of San Diego and President of the City Bank of Monrovia. He is also President of the National Iron Works of San Diego.

Born in Oregon, Mr. Smith moved to San Diego when still a youth and attended the public schools in that city. He later resided in Los Angeles for several years. He is married and the father of two children, a boy and a girl.

Noyo River Bridge

(Continued from page 16)

channel 140 feet wide and a vertical clearance of 80 feet.

In order to economically obtain the required clearances the new bridge was located about 1,000 feet downstream, where rugged bluffs on each side of the channel would place the approach roadway at the proper elevation above the water. Further study indicated that a saving could be made by combining in one line change the replacement of existing weak bridges across Mitchell Creek and Hare Creek. Both of these bridges were of light timber construction in bad condition. Both were restricted as to loading and were being kept in service by constant repairs and replacement had been scheduled as an early postwar project.

To coordinate the construction work the entire project has been included in one contract. This includes grading and surfacing with plant mixed surfacing a 22-foot roadway about 3½ miles long ending at the south limit of Fort Bragg. At Mitchell Creek a 10-foot concrete arch culvert 385 feet long is to be built. At Hare Creek the bridge is to be a three span reinforced concrete arch. Side spans will be 90 feet and the main span is to be 199 feet. The deck will provide a 26-foot roadway and two three-foot sidewalks.

About half of the cost of the project is in the bridge across the Noyo River, which will be a structural steel cantilever with a main span of 405 feet and side spans of 222 feet. The deck will provide a 26-foot roadway with three-foot sidewalks.

Bids on the project were received on August 28, 1946, and Contractor Guy F. Atkinson was the low bidder with a bid of $1,322,647. Before the contract could be awarded, President Truman proclaimed structural steel a critical material and ordered the deferment of all public works projects including quantities of structural steel. To conform to the presidential policy a revised contract for $874,215 was negotiated with the contractor, which eliminated the structural steel superstructure of the Noyo River Bridge. The piers and abutments are to be constructed under this contract which will permit the rapid completion of the bridge when the structural steel is obtainable.



Showing culvert and fill replacement of old Slick Rock Bridge, Mendocino County

Replacement of Posted Bridges in District 1

(Continued from page 21)

flat bottom land developed in part by reclamation. Upon reaching a confluence they flow in a common channel to discharge into Clear Lake. This common channel is inadequate for carrying the peak run-off of storms and consequent flood waters are ponded and flood all low areas, particularly those drained by Scott Creek. These flood waters overflow the existing highway by as much as five feet and effectively block all traffic using Route 29 north from Lakeport to the junction with Route 20 at Upper Lake. The new highway has been located and designed to correct this condition.

ALL WEATHER ROAD

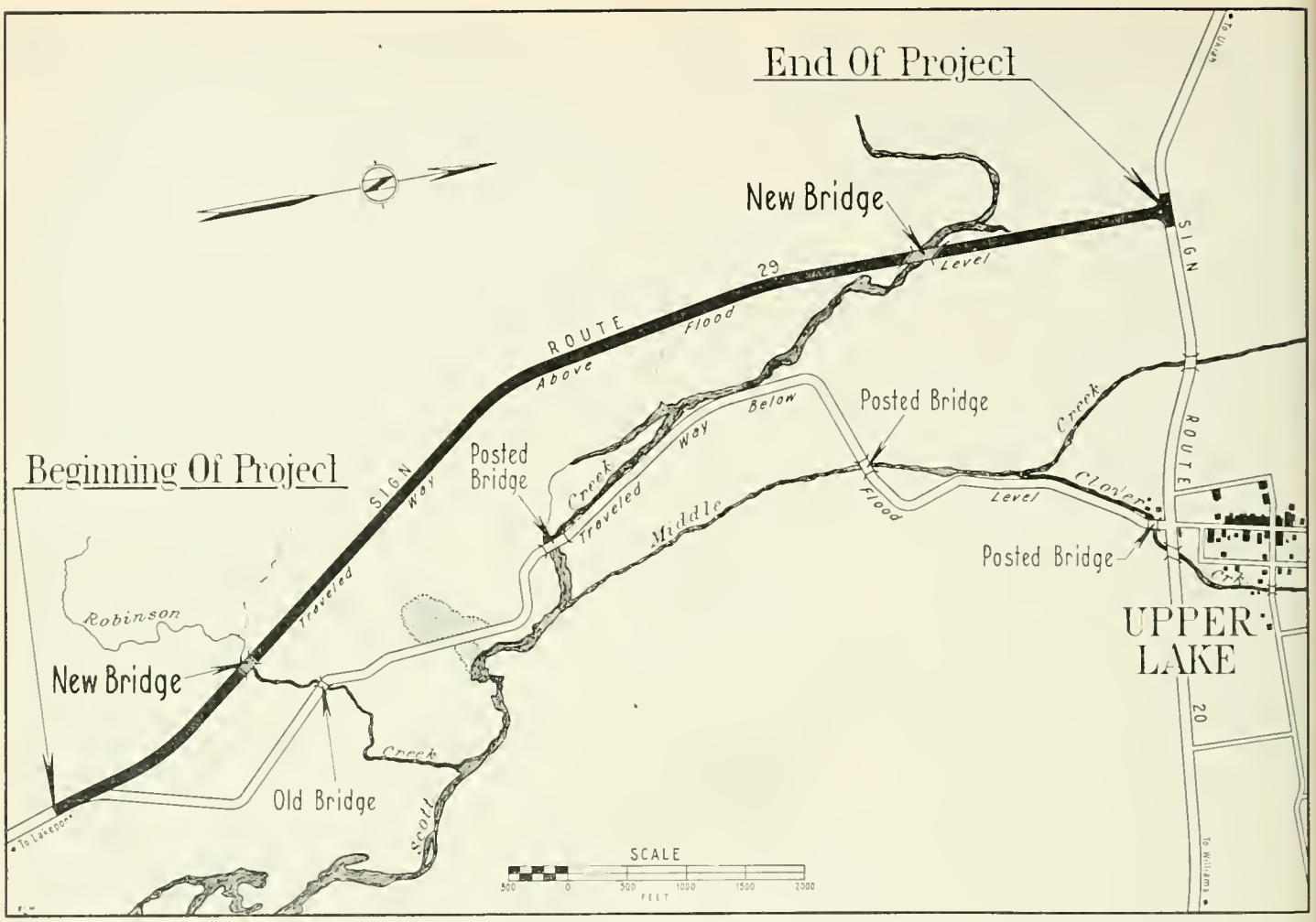
The new highway, besides eliminating three bridges from the highway system and providing an all weather road, will replace 2½ miles of road construction on narrow and winding alignment. The new location has only three curves, the minimum radius being 1,500 feet and the road is surfaced to its full width, with three inches of plant-mixed surfacing on imported base material. A "Y" type intersection, having acceleration and deceleration lanes on Route 20 was constructed at its northerly termini near Upper Lake.

The grading and surfacing of the new highway is now completed but is not open to traffic. The substructure for the new Scott Creek Bridge is completed but nondelivery of the steel girders has prevented completion of the structure. Work on the reinforced concrete pile bridge at Robinson Creek is underway with completion of both bridges anticipated early next summer.

The contractor for the grading and surfacing contract was Louis Biasotti & Son, and Kiss Crane Company for the bridges. The Resident Engineer for the grading and surfacing was C. A. Shervington, and Resident Engineer G. A. Crayton as supervising the bridge contract. The estimated cost of both projects is $317,000.

Further south on State Route 29, near Kelseyville, Contractor A. Soda & Son has completed the substructure for a steel girder bridge 372 feet in length which will replace an existing steel truss bridge across Kelsey Creek.

The existing structure was constructed by Lake County many years



ago. Its restricted width and height and light steel members necessitated posting for one-way traffic and a maximum loading of seven tons for one vehicle and 12 tons for semi.

Approaches to the new bridge have been graded and surfaced and are in use, but completion of the new bridge has been delayed by the nondelivery of steel girders. By arrangement with the contractor a pile timber span and approach fill have been constructed from the easterly pier of the old bridge to permit traffic to use that bridge. Otherwise, traffic entering or leaving Kelseyville would have been required to make a detour of several miles. This replacement of a posted bridge, estimated to cost $214,000, will provide 0.65 mile of new highway on high standard alignment. It is a matter of interest that the first bridge built across Kelsey Creek at this location in very early days, a timber pile structure cost approximately $2,500. The Resident Engineer representing the Bridge Department is George A. Greene who was assisted by R. L. Myers on the grading and surfacing portion of the contract.

The construction of these new structures will go a long way toward correction of the critical deficiency bridge problem in Lake County where free flow of truck traffic has been restricted for many years.

Bay Area Metropolitan Traffic Survey Made

(Continued from page 24)

by the small number of refusals, four-tenths of one percent.

Taxi interviews were 90 percent complete at the end of January, at which time the truck interviews were begun. The data from the internal survey furnish the material for estimating traffic generated by residents of the Bay area as it is defined in this study.

The traffic created within the area by residents from other parts of the State is had through an "external survey" in which vehicles on all principal routes leading into the area are intercepted and the drivers questioned as to origin, destination, and place of residence.

In the external survey approximately 70,000 interviews have been obtained. These interviews also will be completed in April.

It is yet too early to assess fully the values of such studies. One thing, however, is clear. They will permit a coordinated attack on the traffic problems of metropolitan areas and enable those problems to be looked at as a whole, hence with greater possibility of solution than heretofore possible.

Unique Method for Pile Encasement For Newport Bay Bridge Successful

By W. H. JOHNSON, and C. J. BEER, Resident Engineers

TO OBTAIN maximum service life from existing state bridges, the Bridge Department of the Division of Highways frequently has had to develop methods for repairing timber piling damaged by decay and marine borers. One of the preferred methods consists of encasing defective piles in concrete extending from high water line to about five feet below the mud line.

Recently, 33 timber pile bents of the bridge across the North Arm of Newport Bay, on the Coast Highway between Los Angeles and San Diego, were repaired with concrete encasements. Novel feature of the method was the building of circular concrete pile jackets above the water, which were then lowered to the bottom and filled with tremie-deposited Portland cement grout. Significant details of the construction are shown in **Figure 1.**

Scaffolding was suspended just above the high tide elevation by ropes tied over the caps. All work was done from the scaffolding.

The first operation was to clean the piles of barnacles, mussels and other marine growth.

The next step consisted of constructing a concrete cylindrical shell around each pile. A two-inch space was left between pile and inside of shell, which was later filled with grout. The shell extended from high tide to an elevation of three to five feet below the mud line.

HOLLOW SHELLS GUNITED

The hollow shells were gunited in five-foot lifts. After completing each lift, the shell was lowered five feet. This continued until the final depth was obtained. The construction of the concrete shell was started by nailing 1 inch x 2 inch vertical strips to the piles above high tide elevation. These provided the two-inch minimum space for grout filling.

In order to facilitate the lowering, these strips were placed with a slight taper. This was accomplished by nailing rope around the pile below the tops of the strips. A thin layer of asphalt felt was laid over the form strips to act as the inside form. Wire mesh reinforcement, crimped to keep it off the felt, was then fastened in place over the felt. Two S-shaped hooks and guides were placed in the form, 180 degrees apart, and later cast in the concrete. Two C-shaped guides were placed at the quarter points. The hooks served to hold up the shell during construction, and the guides prevented the shell from crowding the pile during the lowering operation. A 1½ inch concrete jacket was then applied pneumatically through a hose and nozzle.

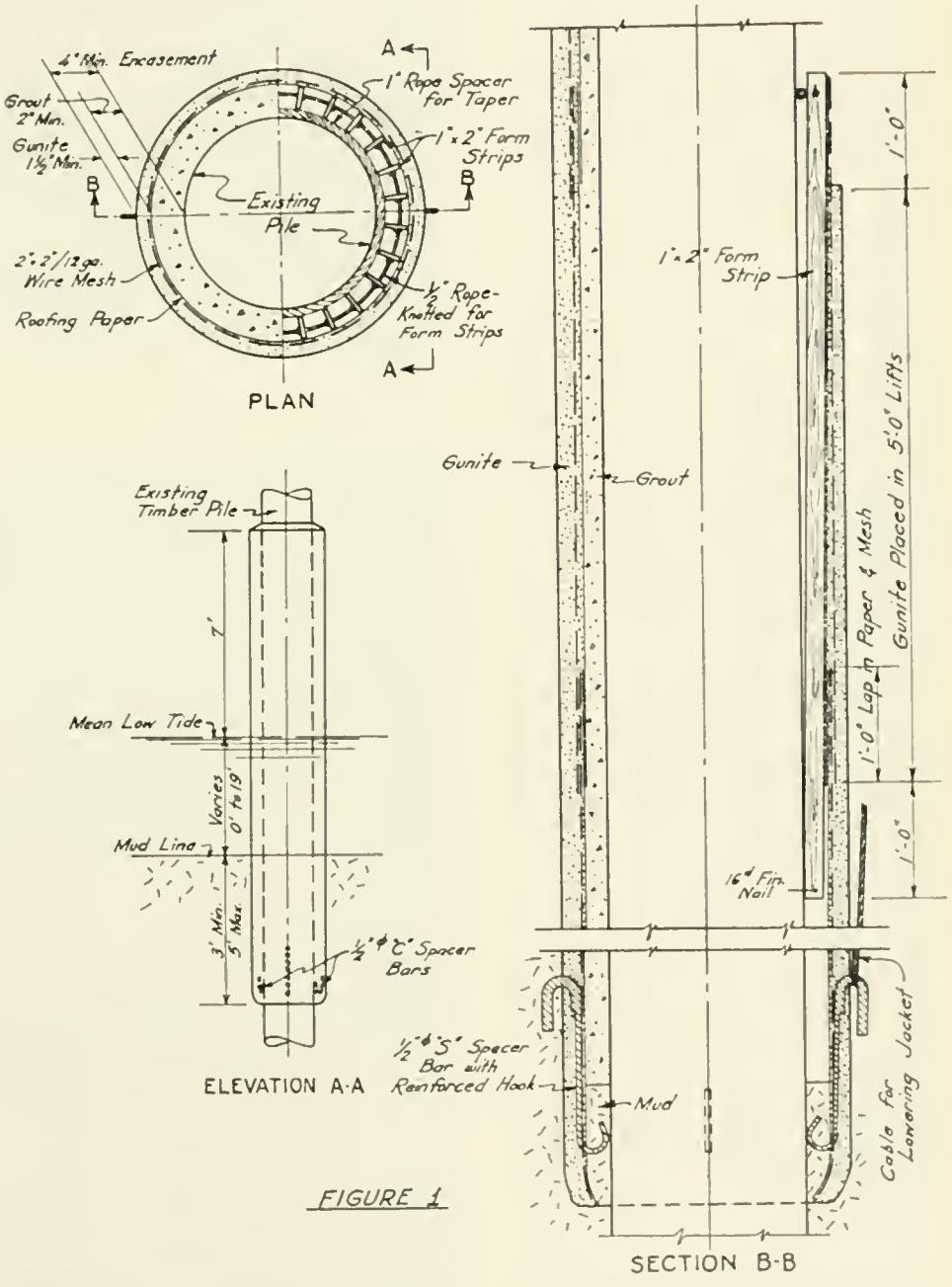


FIGURE 1

This completed the first step of the encasement operation. After the concrete had set the jacket was lowered away from the form strips, and another section cast on top of the previously cast section. The same form strips were used, and new felt, reinforcing and gunite applied in the manner already described.

When the bottom of the jacket reached the mud, a 1½-inch water jet was used to loosen the material and allow sinking the jacket to five feet below the mude line. **Photograph 1** shows jetting under way as the jacket is being lowered. Jacket in the right foreground has already been lowered and is ready for the next lift to be formed.

GROUT FILLING

After the "gunite" jacket was in final position, 1:2½ Portland cement grout was deposited in the annular spaee between the pile and the asphalt felt back of the jaeket. This was donė by a process patented by Johnson-Western Co., contractors on the job. Grout was mixed in a 10-sack mixer, conveyed to a "grout bin" where it was placed nnder air pressure, and delivered through 1½ inch rubber hose to a flexible steel tremie hose. The tremie was inserted in the annular space at the top of the pile jacket and pnshed down to the mud line. It was found that after jetting to sink the jacket, mud rose only one or two feet in the annular space. This placed the bottom of the grout about three feet below the outside mud line. Water in the annular space was displaced upward by the rising grout and flowed out over the top of the jacket.

After the grout filling hardened, tops of the encasements were tapered off and finished with the "gunite" machine. Sway bracing, removed during encasement operations, was replaced and new sash braces were added at each bent.

Photograph 2 shows two completed bents with jaekets on two other bents ready for another lift to be constructed.

A considerable amount of boat traffic, chiefly pleasure craft, uses the main channel under the steel span of the bridge. A timber bulkhead 14 feet high is used to protect the double pile bents at each end of this span from damage by boats. The lower half of the bulkhead had been badly damaged by marine organisms and was replaced with new creosoted timber. The upper half was reinstalled after pile encase-







Twelve Miles of U. S. 40 Converted To Four-Lane Divided Highway

(Continued from page 27)

hents were completed. To stiffen the ile bents supporting the bulkhead, even foot "gunite" diaphragm walls ere built between groups of three nd four piles in these bents.

Photograph 3 shows mortar being pplied to one of the walls and illus- rates the method of application to ll of the pile jackets.

A heavy submarine telephone cable, esting against the timber piles aused some difficulty in sinking two f the concrete jackets to the specified epth. Investigation by a diver dis- losed a slight arc in alignment of the able, from which slack might be ob- ained. By using a water jet and a eries of chain hoists the diver was ble to lift the cable out of the mud nd rearrange slack sufficient to clear he pile jackets. This work was done y force account under a contract hange order. **Photograph 4** shows tiving work in progress.

being erected adjacent to the legal entrances so that traffic must use the approved and legal entrances to these places.

These curbs are placed within the right of way one foot from the right of way line. At each side of all of the legal private openings an 8 inch x 8 inch concrete marker is placed on the right of way line. In order to appraise the general public on all freeways or limited freeway routes, signs are being placed at one-fourth mile intervals near the right of way line informing the public that this is a limited access project, and that only authorized access openings may be used. This will inform prospective purchasers of the necessity of determining whether property they are contemploaing buying has a legal opening to the highway. Many cases have already been disclosed, where property has been purchased, and after the purchase was completed, the purchaser discovered he had no legal right of ingress or egress to the highway.

The second project, Midawy to 1.3 miles north of Dixon, makes a saving of 1.3 miles over the old route and takes traffic completely outside of the metropolitan development of the City of Dixon.

Both of these projects were constructed by the same contractor, Frederickson Bros. of Emeryville. George R. Hubbard was resident engineer until the pavement was nearly completed when, on account of illness, the work was completed by W. L. Hurd who had assisted throughout the construction.

The estimated final construction cost for both projects totals $1,676,000.

Both projects were constructed during the same epproximate period of time which shows 219 working days on one project and 245 on the other. The first project was started January 3, 1946, and the second February 13, 1946.

The improvement in riding comfort resulting from a smoother pavement surface; a decrease in the activity of back seat drivers, on account of the removal of nearly all curves and the greater safety provided for passing vehicles by reason of the divided highway; and the decrease in the time of travel which induces an increase in the number of trips and permits of trips which time would not otherwise allow, would all indicate that this construction was primarily to increase business for the oil companies. A further analysis however would prove that the automobile or truck owner himself saves time and cost in the operation and maintenance of his equipment, and this saving, together with the saving in lives, equipment, and insurance costs, due to the decreased accident hazard, is passed on to the general public in lower commodity costs and improved services.



4

Maintenance Crews Expect to Do These Things As Routine

Mr. A. J. Rivett, Safety Engineer
Division of Highways
Room 529, 1120 N Street
Sacramento, California

Dear Mr. Rivett: Because I believe you should know and because I am confident you will be pleased to learn of the details, it affords me great pleasure to relate an experience I had this afternoon.

Proceeding south on the East Shore Highway (skirting San Francisco Bay between Albany and the East Bay Bridge) and at a point approximately 200 yards north of University Avenue, Berkeley, I just managed to evade an empty barrel that rolled across the highway directly in front of me. In my rear vision mirror I saw a great bit of dodging on the part of motorists following me and witnessed some mighty close shaves between many cars in their frantic attempts to go around the barrel.

The wind seemed to be changeable at that point for my last vision of the barrel disclosed it rolling in the opposite direction but, of course, right across the highway which is, as you know, a very busy thoroughfare.

Arriving at the University Avenue intersection I noted one of your highway trucks and a crew which was, I believe, painting the electric light poles. Pulling off the highway, I reported the hazard created by the barrel. Two men were immediately dispatched to remove the hazard and although nothing was said about hurrying these men started off on the double.

The prompt reaction of these men may have averted a serious accident.

I regret that I failed to note a number on the truck but with the description of the location and knowing the time (2.30 p.m.) it is likely you will know the men comprising the crew who should, I believe, be commended for their eagerness to remove a dangerous hazard from the highway.

Yours truly,

Jenkel-Davidson Optical Company

F. P. Schaeffer,
Sales Manager

Farm Can Help Provide Steel For Bridges

WARTIME'S spirit of metal salvage is again being called upon, this time for highway bridges. That old cultivator or other antiquated farm machinery rusting away in the barnyard can help the road program by supplying iron and steel scrap for modernizing old bridges and building new ones, according to Charles M. Upham, engineer-director of the American Road Builders' Association, in a statement issued to highway engineers.

Mr. Upham, in supporting the government's plea for scrap salvage, points out that lack of steel has been one of the obstacles holding up highway construction.

"Roads crossing streams must have bridges, and thousands of highway projects cannot be started because steel for bridges is not available," said Mr. Upham. "In a normal prewar year, highways used over 1,600,000 tons of structural and reinforcement iron and steel. Since it is estimated that 30,000 bridges on state roads alone are obsolete and must be replaced, postwar requirements will be greatly in excess of the prewar consumption. There are 800,000 bridges in our street and highway system, 600,000 in rural areas and 200,000 in urban areas."

In Memoriam

William Bryant Thompson

With the passing of William Bryant Thompson a wife lost a devoted husband and the engineering profession a member whose capacity for accuracy and detail was unexcelled either in design or application.

"Bill" Thompson was an honor student of the class of 1904 University of Nevada where for a while, following graduation he was a member of the faculty.

His early practical experience was gained in the relocation and double-tracking of the Southern Pacific over the Sierra Nevadas. Later he was Assistant Engineer in Maintenance located in Sacramento.

In 1928 he came to the State Division of Highways as Chief of Party, District X and later in District IV.

When the San Francisco-Oakland Bay Bridge project was assured in 1933 he was put in charge of East Bay surveys and the distribution structure. Here he gained wide reputation among engineers for his exactness and his keen sense of loyalty. After seeing the bridge in operation he retired from active engineering and made his home in Modesto.

In 1917 while he was consulting and locating engineer for the Verdi Lumber Co. he met and married the postmistress, Miss Mabel Soden, who now survives him.

Following a lingering illness death came on October 25, 1946. Services were held in Shannon Chapel, Modesto, and his ashes repose in Masonic Lawn.

Construction of Willow Pass Under Way

(Continued from page 19)

The right of way for the project was secured on the basis of a limited access freeway limiting ingress and egress from adjacent properties to stipulated locations and providing crossovers through the central division strip at carefully selected locations.

Present operations on the project consists of grading and drainage structures with contemplated paving being under way in the early spring, permitting completion early in the summer of 1947.

Near the easterly end of the project the roadway crosses the 65-inch water line of the East Bay Municipal Utility District.

At this location a second 60-inch pipe is being installed for future service and both conduits are being encased in a reinforced concrete jacket under the roadway section for their protection.

The cost of the project exclusive of right of way costs is $620,000.

Harms Brothers of Sacramento are the contractors on the project with Jim Sheldon as their general superintendent. The work is under the general supervision of Jno. H. Skeggs, District Engineer, R. P. Duffy, District Construction Engineer and G. L. Beckwith, Resident Engineer.

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Department of Public Works

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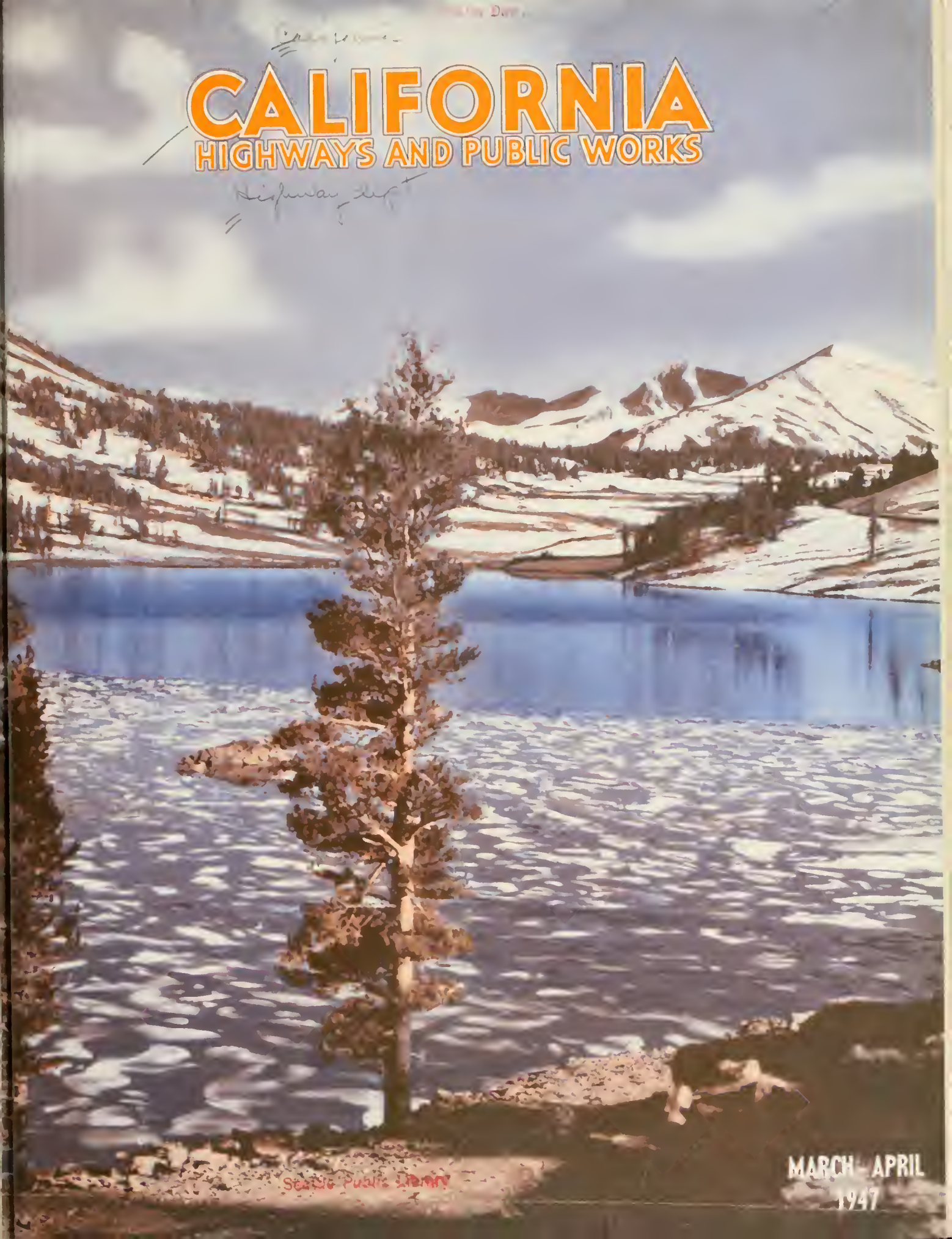
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MARCH - APRIL
1947

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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C. H. PURCELL, Director — GEORGE T. McCOY, State Highway Engineer — K. C. ADAMS, Editor

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California Counties Launch* Construction of 55 Bridges to Cost Approximately $5,575,000

By C. L. HOLLISTER, Senior Bridge Engineer

[F YOU do not have occasion to get off the main state highway routes on to the county roads you are issing many of the beauty spots of e state. Many of these roads lead to ints of great historic interest and areas of wonderful recreational fa-lities; in addition they pass through me of the most fertile agricultural nds in California.

These county roads are feeders of e main traffic arteries over which ss the commercial products of for-ts, farms, ranches, mines and indus-ies, which together form the vital fe line of the vast rural population of e State of California.

The United States Congress of 1944 d the State Legislature of 1945 rec-gnized these facts and allocated cer-in funds to assist the counties with three-year program of county road d bridge improvements.

The counties of California have ap-roximately 11,600 bridges of which 261 are inadequate and need early placement because of structural eakness or impaired clearances. herefore, many of the counties are isely choosing to replace as many as ssible of these structurally weak ridges from the funds made avail-ble.

Envisioned in the federal and state ts was the establishment of county ighway engineering personnel in sition to carry on a continuing high-ay and bridge program.

BIG SUMMER PROGRAM

The counties have therefore been usy the past year getting many ridge projects planned for imme-iate construction this summer, and is believed that by the beginning of e summer construction season the ounties will have under way 55 ridges with a total value of approxi-nately $5,575,000.

In order to facilitate the program, new section in the state highway rganization was created in June, 945, under H. B. La Forge, Engineer

The architectural sketches which accompany this article were drawn by Van der Goes of the Bridge Department of the State Division of Highways.

of Federal Secondary Roads, to work with the counties toward the end outlined above. At the same time F. W. Panhorst, Bridge Engineer assigned the writer to assist on bridge projects. These engineers, along with those of the Public Roads Administration, are cooperating to their fullest extent with the counties on their bridge replacement programs in the following manner:

(1) Working with the counties in selection of bridge sites and the most economical and serviceable type of structures.

(2) Reviewing plans and estimates and preparing specification for advertisement.

(3) Assisting counties with construction problems.

(4) Advising and working with counties in maintenance and repair of these structures after completion.

COUNTIES PREPARE PLANS

Many of the counties are finding it possible to prepare bridge plans and estimates with their own forces; many are employing the services of consulting engineers, and in a few cases counties have requested assistance from the State in the preparation of their plans.

In all cases the Bridge Department is attempting to give the counties the most advanced technical service available for the design and construction of their bridges.

While the State has not requested that its standards for curbs, railings, walks, slabs, culverts, drains, and other details be used, most of the counties realize the advisability of adopting a uniform state-wide system of bridge construction details. Such a system of standards tends to reduce construction costs, simplifies preparation of plans, and provides structures with the most serviceable details based on state-wide maintenance experience.

The first year's bridge program of the counties includes many interesting types of structures such as slabs, steel and concrete beam spans, trusses, arches, and movable spans of both the swing and vertical lift types.

Following is a list showing what each county is planning in the way of bridges to be built under the program for the first year. It also tells how the various counties are proposing to handle construction engineering on these bridge projects.

Pictures show some of the existing bridges to be replaced; and architectural sketches show some of the proposed new bridges.

BUTTE COUNTY

Bert N. Paxton, County Engineer, has under construction a bridge across South Fork of Feather River at Bidwell Bar. **(See picture of existing bridge to be replaced.)**

This structure is a modern reinforced-concrete girder bridge designed for heavy trucks, providing a 26-foot roadway with two small walkways. When completed it will facilitate movement of much needed lumber from this area. The State is to furnish Resident Engineer and the county is to furnish assistants.

Approximate cost, including engineering and contingencies____ $110,000

CONTRA COSTA COUNTY

Joseph W. Barkley has plans for a bridge across Pacheco Slough, bids for which were received on March 26th.

* See articles in July-August, 1945, and November-December, 1946, "Highways and Public Works."

This structure is a hand operated swing bridge with concrete slab approaches. This structure is in an industrial area and will carry the products of steel mills and oil refineries. The county proposes to handle construction engineering with its own forces.

Approximate cost, including engineering and contingencies____ $250,000

COLUSA COUNTY

County Surveyor de. St. Maurice is preparing to improve the capacity of the existing bridge across Sacramento River at Colusa by strengthening and providing a modern steel grid floor. This structure is in a rich agricultural land and will carry the products from farm to market. Bid opening date was April 2d. The State will furnish construction engineering.

Approximate cost, including engineering and contingencies____ $150,000

Plans are also under way for a reinforced-concrete structure across Stone Coral Creek. It is planned to have this job under way this summer.

Approximate cost, including engineering and contingencies____ $25,000

DEL NORTE COUNTY

Harry M. Malpas, County Surveyor, has plans under way for early advertisement of a bridge across South Fork of Smith River. **(See architectural sketch.)** This structure will be a modern steel arch, designed for a 15-ton truck and trailer, providing a 24-foot roadway. This structure when completed will facilitate movement of large quantities of timber from forest lands to the main state highway.

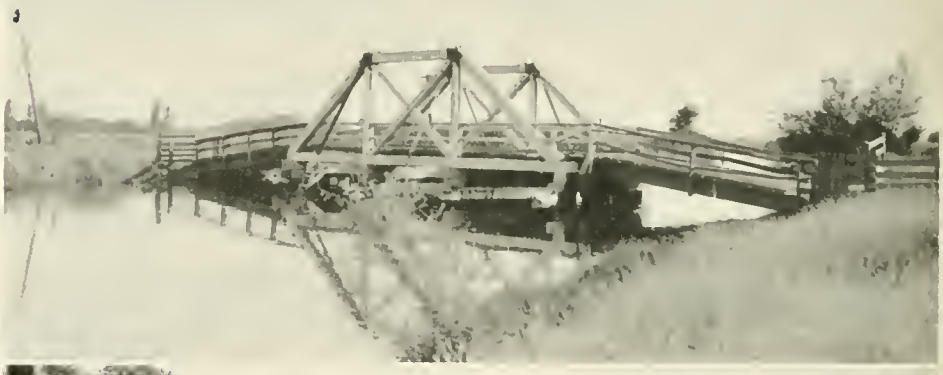
Approximate cost, including engineering and contingencies____ $60,000

FRESNO AND MADERA COUNTIES

J. A. Nielsen of Fresno County and D. O. Houston of Madera County have plans for a bridge across the San Joaquin River at Firebaugh, between Fresno and Madera Counties. Bids are to be received on April 30th. This project will consist of two bridges, one across the main river and one across an overflow area. Each will consist of a series of steel stringer spans with a 26-foot roadway. The structure is in a rich agricultural area and will facilitate the movement of products from farm to market. It is tentatively planned to have the State handle construction engineering for the two counties, with assistance from the Counties on inspection and stake out.

Approximate cost, including engineering and contingencies____ $360,000







Upper—Existing bridge across South Fork of Feather River at Bidwell Bar, Butte County. Has been in use since 1856. The wire cables and wrought iron hanger rods were brought by ship around Cape Horn. When replaced it will remain as a foot bridge in the Bidwell Bar State Park. Center—This bridge is typical of many structures which are no longer able to meet the demands of highway traffic and must be replaced as soon as possible. Lower—Russian River Bridge at Hacienda, Sonoma County. A one-way bridge, originally designed for a single track railroad, which for many years has been used as a highway bridge. Reconstruction will provide for spreading the trusses and building new concrete approaches so as to make clearances for two lanes of traffic



This structure is a series of steel girder spans consisting of one main span 90 feet long, two 80 feet long, and one 70-foot approach span. It is located near Lake Almanor in Plumas County, is now under construction, and will be completed early this spring. Insert—Existing structure which will be replaced

GLENN COUNTY

August J. Hoever, County Surveyor, has plans under way for a bridge across Willow Creek. This structure will be a modern reinforced concrete slab bridge designed for heavy trucks, facilitating the movement of timber, cattle and sheep from the area east of Willows. The county proposes to handle construction engineering.

Approximate cost, including engineering and contingencies____ $20,000

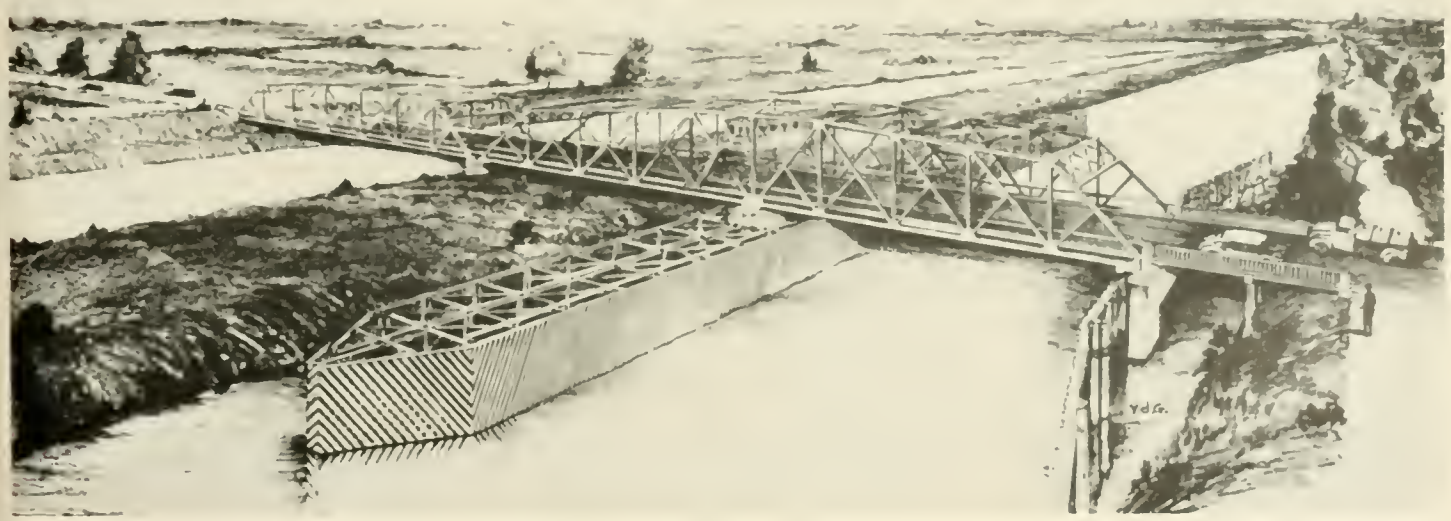
HUMBOLDT COUNTY

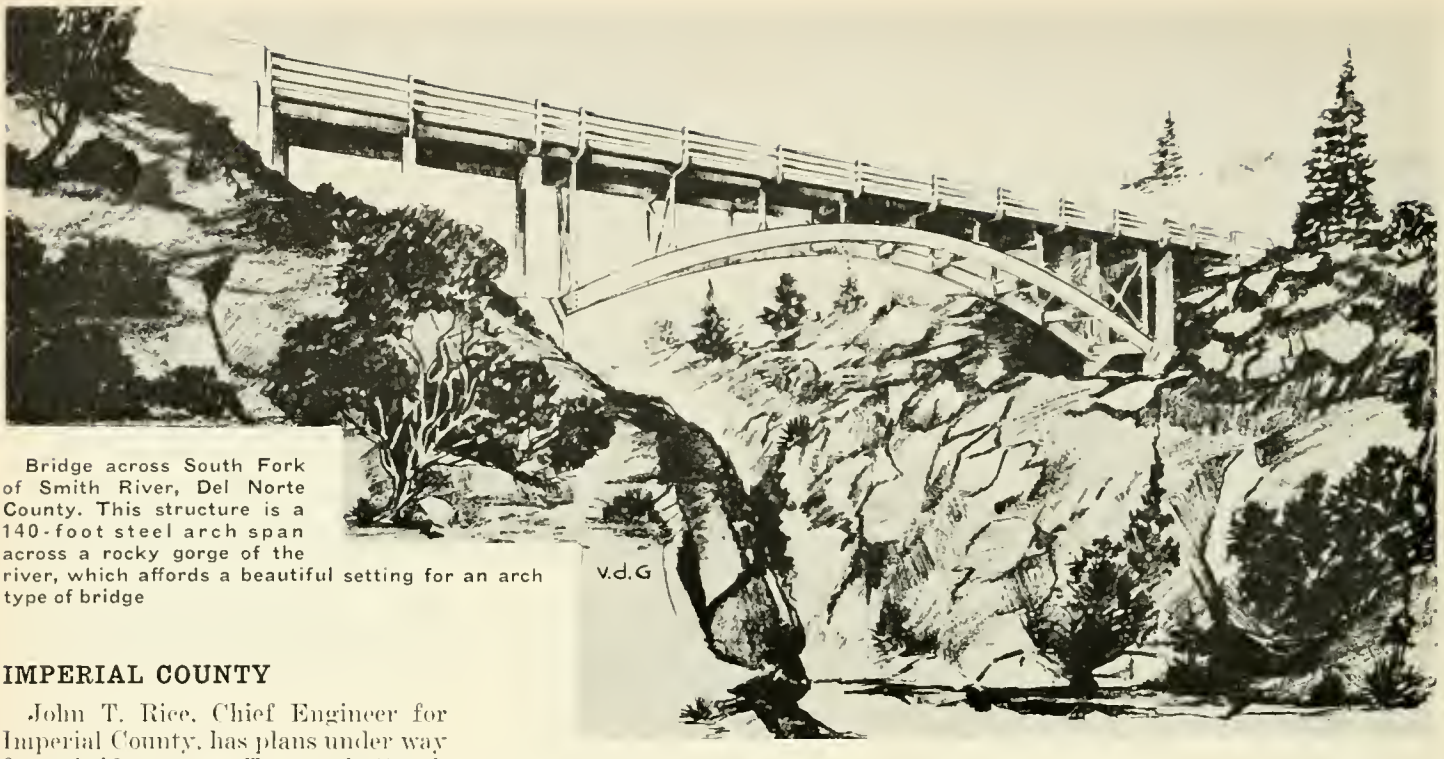
Frank E. Kelly has plans under way for the improvement and refloorring of the bridge across the South Fork of Eel River at the entrance to Whitemore Grove State Park. The existing structure is restricted to one-way traffic. The improvement will allow for two lanes of traffic and greatly facilitate the movement of large amounts of forest products from the area west of the Park to the state highway.

Construction engineering has not yet been worked out with the county.

Approximate cost, including engineering and contingencies____ $45,000

Bridge across Grant Line Canal. Is located on the Tracy Island Road in San Joaquin County. It is to be a modern electrically operated swing span to allow for the passage of boats





Bridge across South Fork of Smith River, Del Norte County. This structure is a 140-foot steel arch span across a rocky gorge of the river, which affords a beautiful setting for an arch type of bridge

IMPERIAL COUNTY

John T. Rice, Chief Engineer for Imperial County, has plans under way for a bridge across Tamarack Canal. This structure will be built as a part of a road contract, which when completed will speed the movement of early spring fruits and vegetables to market.

It is tentatively planned for the State to handle construction engineering with county assistance.

Approximate cost, including engineering and contingencies ___ $35,000

INYO COUNTY

A. A. Brierly, County Surveyor, has two timber bridges to be constructed with a road project. These structures are located in an agricultural area about four miles east of Bishop.

Approximate cost of bridges, including engineering and contingencies _____ $65,000

KERN COUNTY

J. R. Thornton, County Surveyor, proposes to readvertise for construction of a bridge across Kern River. Bids were received in February and rejected because of high prices. This structure is located in an agricultural area to the west of Bakersfield. The county proposes to handle construction engineering with its own forces.

Approximate cost, including engineering and contingencies __ $85,000

KINGS COUNTY AND FRESNO COUNTY

J. R. Hayes, Kings County Engineer, and J. A. Nielsen, Fresno County Engineer, have proposed the Kings River Bridge at Hardwick, between Kings and Fresno Counties, bids for which were received April 9th. This structure is a modern reinforced concrete girder design with a 26-foot roadway. It is located about seven miles northeast of Hanford in a rich agricultural area.

Kings County is to provide construction engineers from its forces.

Approximate cost, including engineering and contingencies ___ $180,000

LOS ANGELES COUNTY

O. F. Cooley, County Road Commissioner, has plans complete for the largest bridge program of any county. The following three jobs are being made ready for early advertisement.

Los Angeles River Bridge at Florence Avenue

This job is a series of 83-foot concrete girder spans with a four-lane roadway and two sidewalks. It will facilitate the movement of heavy traffic in an industrial area of Los Angeles County.

Approximate cost, including engineering and contingencies ___ $475,000

San Gabriel River Bridge

This job consists of four 150-foot steel deck truss spans with a 26-foot roadway and two sidewalks. It is located in the San Gabriel Mountains and serves a popular recreational area.

Approximate cost, including engineering and contingencies ___ $540,000

Santa Clara River Bridge and Southern Pacific Railroad Overhead

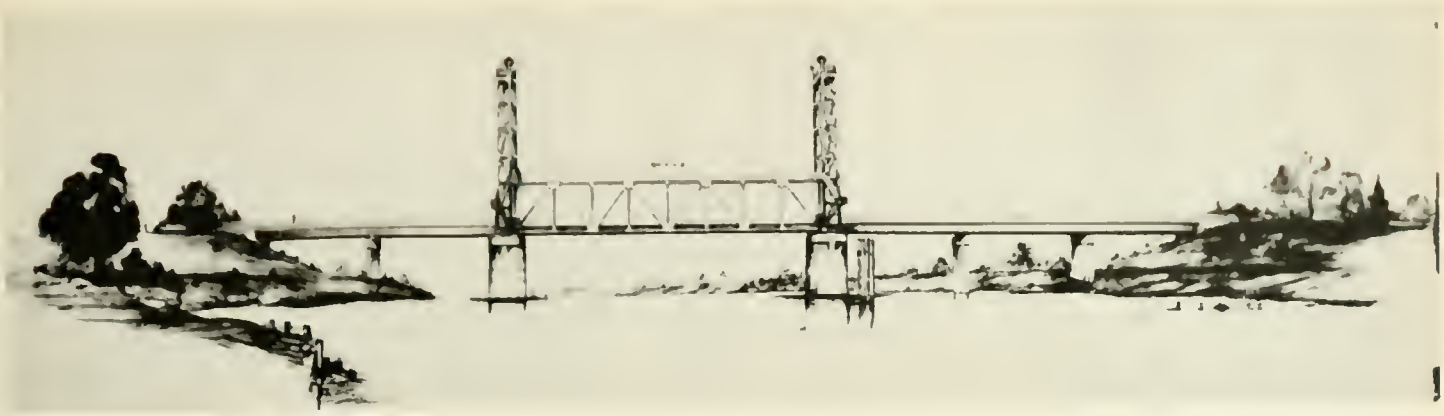
This structure consists of two 145-foot and two 106-foot girder spans with a 26-foot roadway. This structure is located in the Santa Clara River Canyon and will carry heavy trucking between Palmdale and Los Angeles.

Approximate cost, including engineering and contingencies ___ $300,000

Bridge Engineer S. R. Kennedy of Los Angeles County has prepared the design for these structures and will handle construction engineering with the county's engineering staff.

MADERA COUNTY

D. O. Houston, County Surveyor, has plans ready for a bridge across Fine Gold Creek for which the bid opening date was April 2d. This structure is a steel stringer design with 24-foot roadway and will facilitate the



Napa River Bridge. This structure is to be located on a new county road cutoff south of Napa. It is a 90-foot vertical lift type to facilitate movements of boats on the river

hauling of timber from forest lands from the mountain slopes east of Madera.

The State will provide construction engineering with assistance from the county.

Approximate cost, including engineering and contingencies --- $95,000

MARIPOSA COUNTY

County Surveyor F. A. Casaccia, proposes to have under construction early this summer six small bridge structures across De Long Creek, Bear Creek, Corbett Creek, Middle Fork Chowchilla Creek, North Fork Chowchilla Creek and Pegleg Creek.

It is tentatively planned that the State will furnish construction engineering with assistance from the county.

Approximate cost, including engineering and contingencies---- $95,000

MENDOCINO COUNTY

Russell Cummins, County Surveyor, proposes to have under construction early this summer two bridges, one across Chamberlain Creek which will serve a vast area of forest lands, and one across Morrison Creek which will serve a rich agricultural area.

The county proposes to provide for construction engineering from its own staff.

Approximate cost of the two bridges, including engineering and contingencies ---------- $55,000

MONTEREY COUNTY

Howard F. Cozzens has plans ready for early advertisement of a railroad grade separation structure. The structure will provide for two lanes of traffic over the main line tracks of the Southern Pacific Company south of Salinas. The new structure and highway will facilitate the movement of a large volume of traffic between a new industrial area and a new housing area which are now separated by the railroad. **(See architectural sketch.)**

It is tentatively planned for the county to handle construction engineering on this project.

Approximate cost, including engineering and contingencies --- $250,000

NAPA COUNTY

Ed. P. Ball, County Engineer, has plans for a bridge across Soda Springs Creek. This structure is to be built in conjunction with a road project for the improvement of the Silverado Trail Road which serves the east side of the rich Napa Valley agricultural area.

County engineering staff will handle construction engineering.

Approximate cost of bridge, including engineering and contingencies ---------- $15,000

Napa County also has planned for the future a road and bridge project between the two main highways south of Napa. This project will provide a cut-off and relieve the city streets of a great deal of heavy traffic including a large volume of trucking. The bridge will span the navigable Napa River and will be a vertical lift type **as shown in architectural sketch.**

Approximate cost of bridge, including engineering and contingencies ---------- $300,000

PLUMAS COUNTY

A. J. Watson, County Surveyor, now has under construction a bridge across Hamilton Branch. **(See architectural sketch.)** This new bridge and road will facilitate the movement of lumber and serve a large recreational area in the vicinity of Lake Almanor.

The State is handling construction engineering with assistance from the county.

Approximate cost, including engineering and contingencies --- $75,000

SACRAMENTO COUNTY

Edwin A. Fairbairn, County Engineer, has three bridge projects under way.

The Laguna Creek Bridge **(see picture of completed structure)** is located just north of Elk Grove. It facilitates the movement of farm products in this area. Plans were prepared by the county. The State is handling construction engineering with assistance of the county engineering staff.

Approximate cost, including engineering and contingencies --- $35,000

The bridge across Bear Slough is now under construction and when completed will serve a large agricultural area. **(See picture of existing bridge with work under way for new construction.)** New bridge is a series of reinforced concrete slabs with a 26-foot roadway.

Plans were prepared by the county. The State is handling construction engineering with assistance from the county.

Approximate cost, including engineering and contingencies --- $80,000



Laguna Creek Bridge. This structure is just north of Elk Grove in Sacramento County and is the first bridge to be completed under the present program. It is a modern reinforced concrete slab structure with a 30-foot roadway and was designed by the county

The bridge across Arcade Creek on Madison Avenue is now under construction. It will serve a farm and suburban home area. Construction engineering is being handled by the State with assistance from the county.

Approximate cost, including engineering and contingencies____ $20,000

SAN BERNARDINO COUNTY

Howard Way, County Engineer, has prepared plans for two bridges, one across Santa Ana River and the other across Timoteo Creek. Bids were received March 6, 1947. These bridges are of the steel stringer type, with a 30-foot roadway and 2-foot walkways. These bridges and road when completed will provide an important traffic artery which is now cut off during flow of water in Santa Ana River.

The county will handle construction engineering on this project.

Approximate cost of bridges, including engineering and contingencies _____ $260,000

The county also proposes another bridge of similar type across City Creek. Plans are now being processed by county and the job should be under construction this summer.

Approximate cost, including engineering and contingencies____ $60,000

SAN JOAQUIN COUNTY

Julius B. Manthey, County Engineer, plans two bridges under the first year's program, one across the Mokelumne River on Peltier Road, bids for which were received on April 9th. This structure will provide new facilities for the movement of farm products across the river between Thornton and the main State highway north of Lodi. This structure consists of one 150-foot through steel truss span with 730 feet of reinforced concrete slab approach spans. A 24-foot roadway is provided.

The county will provide for construction engineering on this project.

Approximate cost of bridge, including engineering and contingencies _____ $200,000

The other bridge project planned for early advertisement is the Grant Line Canal Bridge on the Tracy Island road. **(See architectural sketch.)** This structure will facilitate the movement of large quantities of fruits and vegetables to canneries. This structure will consist of a 250-foot electrically operated swing span with a 150-foot through steel truss approach span. A clear 24-foot roadway is provided.

The county will handle construction engineering with its own forces.

Approximate cost, including engineering and contingencies____ $375,000

Santa Clara River Bridge and Southern Pacific Company Overhead. This structure is located in Santa Clara River Canyon, Los Angeles County. It consists of two 145-foot and two 106-foot girder spans. It crosses the canyon on a sharp skew and to simplify girder fabrication, single leg piers are used to eliminate necessity of skewing girders. Designed by county.





Existing bridge across Pacheco Slough Bridge in Contra Costa County which is to be replaced

SANTA CLARA COUNTY

R. B. Chandler, County Surveyor, has two bridge widening projects under construction.

The existing 48-foot concrete arch at Llagas Creek is being widened under a road contract. This job is located just east of Gilroy and the project when completed will serve a rich agricultural area.

The Stevens Creek Bridge about 8 miles west of San Jose is also being widened along with a road project. This structure will facilitate the movement of cement and agricultural products to market.

The State is handling construction for the county on these projects.

Approximate cost of bridge work $75,000

SANTA CRUZ COUNTY

Arnold M. Baldwin, County Surveyor, has the Corralitos Creek Bridge project ready for immediate advertisement. This project is located about one mile north of Watsonville and serves a rich agricultural and recreational area. The structure is a 70-foot reinforced concrete girder frame with two 19-foot cantilever end spans. A 30-foot roadway with two 3-foot 6-inch sidewalks is provided. The county tentatively plans to handle construction engineering with its own forces.

Approximate cost of bridge, including engineering and contingencies $60,000

SOLANO COUNTY

Will A. Jones, County Engineer, has five bridges for construction. Bids were received March 12th. Two bridges are across Pleasants Creek, two across Alamo Creek and one on a tributary to Putah Creek. These structures are located in Pleasants Valley, all within nine miles of Vacaville.

This is a farming and recreational area and is especially beautiful in the early spring.

The county will handle construction engineering with its own forces.

Approximate cost, including engineering and contingencies ... $100,000

SONOMA COUNTY

Marshall M. Wallace, County Surveyor, has two bridges planned. The Russian River at Hacienda (see picture of existing bridge) is now under construction. It consists of widening existing railroad bridge piers and spreading the 200-foot span railroad trusses to provide for a 24-foot roadway and two four-foot sidewalks. In addition, 330 feet of concrete girder and approach spans are under construction.

The county is providing construction engineering for the project.

Approximate cost, including engineering and contingencies ... $140,000

Sonoma County also has plans completed for another bridge across the Russian River. This structure is lo-

Bear Slough Bridge, Sacramento County. This picture shows a portion of the existing structure with construction forms under way for new bridge





Sanborn Road Overhead. Crosses the main line tracks of the Southern Pacific Company south of Salinas, Monterey County. It is a series of steel stringers supported on concrete bents. The overhead is designed for two-lane construction with provisions for widening to a four-lane divided highway. Designed by county

cated a few miles northeast of Healdsburg at Jimtown. The county plans to advertise this project early next spring and when completed it will serve a rich farming area facilitating the movement of its produce. The required length of this structure to provide for the flood waters of Russian River is 1,384 feet. The structure consists of 524 feet of continuous 120-foot pony truss spans over the main channel, with 860 feet of concrete girder and slab approach spans.

The county will handle construction engineering.

Approximate cost, including engineering and contingencies ___ $380,000

STANISLAUS COUNTY

George D. Macomber, County Engineer, has plans ready for immediate advertisement for a bridge across the Tuolumne River about five miles east of Modesto, near Empire. This new structure will replace an old bridge in dangerous condition and will facilitate the movement of produce from farm to market and heavy trucking in this rich agricultural area. The new structure will be about 500 feet long and consist of a series of modern 75-foot continuous concrete girder spans.

It is tentatively planned that construction engineering will be handled by county forces.

Approximate cost, including engineering and contingencies ___ $140,000

TEHAMA COUNTY

Charles A. Luning has plans ready for the immediate replacement of six inadequate and structurally unsafe bridges.

Thomes Creek Bridge at Henleyville, proposed for immediate advertisement, will facilitate the movement of forest products from the mountain slopes west of Red Bluff and Corning.

The structure consists of six 50-foot steel stringer spans with a 24-foot roadway.

Final arrangements for construction engineering have not yet been decided on by the county.

Approximate cost, including engineering and contingencies ___ $115,000

The new Reeds Creek Bridge, one mile south of Red Bluff will replace an inadequate and structurally unsafe bridge. When completed, it will facilitate the flow of trucking and farm products.

The new structure will consist of four 50-foot steel stringer spans with a 24-foot roadway.

Arrangements for construction engineering have not yet been decided by the county.

Approximate cost, including engineering and contingencies ___ $80,000

The new Elder Creek Bridge at Gerber will replace another structurally unsafe bridge, and will facilitate the movement of farm products to market.

This new structure consists of four 50-foot steel stringer spans with a 26-foot roadway.

Approximate cost, including engineering and contingencies ___ $80,000

The new Reeds Creek Bridge, two miles west of Red Bluff, will replace another inadequate structure and will facilitate the movement of farm products.

It will consist of three 50-foot steel stringer spans with a 26-foot roadway.

Approximate cost, including engineering and contingencies ___ $60,000

The new Paynes Creek Bridge at Doles will facilitate the movement of forest products from the forest north east of Red Bluff. The structure will consist of four 50-foot steel stringer spans with a 24-foot roadway.

Approximate cost, including engineering and contingencies____ $90,000

The new Thomas Creek Bridge at Paskenta, will facilitate the movement of ranch and forest products from the west of Corning and Red Bluff. The structure will consist of 50-foot steel stringer spans with a 24-foot roadway.

Approximate cost, including engineering and contingencies____ $75,000

TULARE COUNTY

Tulare County has an extensive bridge construction program planned for immediate construction. T. W. Switzer is County Surveyor.

The county program calls for the construction of ten bridges: Kings River, White River, Porter Slough, Deep Creek, Outside Creek, Irrigation Canal, two bridges across the St. Johns River and two across the Tule River. These projects will all serve the rich agricultural lands of Tulare County and facilitate the movement of fruits, vegetables and grain to market.

Bids are to be received for the White River Bridge on April 16th. It consists of four concrete slab spans with a total

(Continued on page 20)

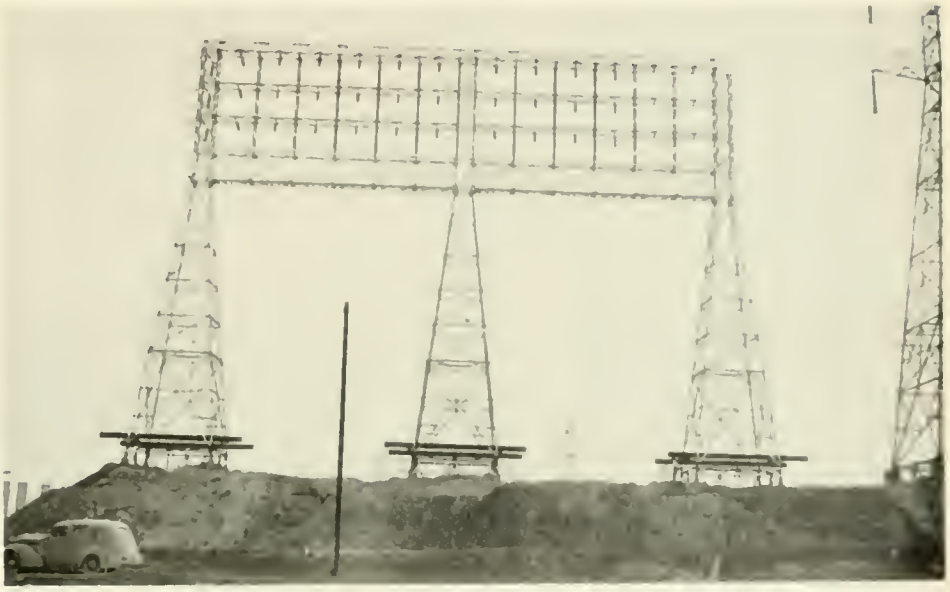
Controlled Settlement of Steel Transmission Towers by Use of Explosives

By S. V. CORTELYOU, District Engineer

ON A PORTION of Route 60, in Long Beach, the State has under contract a section of roadway which eliminates grade crossings at an intersection with the new Terminal Island Freeway. Overhead crossings are to be provided for at the Terminal Island Freeway, Union Pacific Railroad tracks, and the Los Angeles Harbor Department classification tracks.

Plans include relatively high fills on unstable ground between overhead structures. Located just west of the Union Pacific track and adjacent to the new Pacific Coast Highway is a three-tower transmission structure owned by the Southern California Edison Company. The structure shown on the above photograph is one of the Edison Company's 66,000-volt transmission line towers.

In order to provide rapid settlement of highway fills, sand drains excavated to an approximate depth of 40 feet were placed beneath embankments at approximately 12-foot centers. Also, sand drain with counterweight fill is provided around the Edison Company's transmission towers. Tower legs were encased with concrete to the height of the counterweight.



South view of three tower transmission structure showing counterweight fill. I-beam attached to tower bases are for final jacking and leveling

Detail of base plate installed by Southern California Edison Company for final tower adjustment



Agreement between the State Division of Highways and the Edison Company provided for leveling of the towers by means of base plates of variable length, bolted above the new ground line after final settlement. It was further provided, however, that differential settlement during the placing of the counterweight fill must be limited to three inches in line with the three towers and to one-inch transverse to the tower structure.

After completion of sand drains and placing a portion of the counterweight fill around the towers it became apparent that, due to the proximity of the Union Pacific tracks and the existing roadway to the east tower, differential settlement of the structure could not be controlled by surcharge alone. The east tower appeared to offer more resistance to settlement where additional load could not be placed.

At the suggestion of Mr. Jordan Q. Lummis, Transmission Engineer for the Southern California Edison Company, it was decided to try placing a small explosive charge beneath each of the east and center tower footings where the rate of settlement had decreased. At this time the east tower of the structure had settled about 0.35 foot, the center tower about 0.45 foot, and the west tower about 0.60 foot. The west tower was continuing to settle about 0.02 foot per day while the others were practically stationary.

The following day eight four-inch pipes were jetted beneath the four footings of the east and center towers. Approximately five feet beneath each 4-foot by 4-foot concrete spread tower footing of the east tower, an average of ¾ of a stick of 40 percent dynamite was placed. The center tower was similarly loaded through the four-inch pipes with an average of ⅝ of a stick beneath each footing. Pipes were raised and partially backfilled with sand before charges were exploded. Charges were placed below ground water level.

Except for a slight movement of the insulators no vibration in the tower structure was visible.

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U. S. Highway 99 Reconstructed in Redlands

RECONSTRUCTION of U. S. Highway 99 through East Redlands has been recently completed and is being used by public traffic. This modern, four-lane, divided limited freeway has been designed to serve the heavy mixed types of traffic efficiently with abutting commercial development prevented. The roadside and divided strip were effectively seeded and planted to prevent destructive erosion, as well as to preserve the natural beauty of the area.

Through traffic has long had difficulty and delays passing through the Redlands area. The sharp turns and steep grades on the old two-lane route made overtaking and passing difficult for the faster cars, with continuous congestion being the rule.

Redlands is situated in a picturesque and fertile orange growing area. It is the first point at which tourists entering the State by the southern route admire the typical Southern California scene, dominated by orange groves and palm trees.

This project, 2.8 miles long was constructed by contract (Matich Bros.) at a cost of $310,000. The limited access right of way was acquired for an additional $40,000.

The new highway follows through hilly terrain and carries traffic from the Los Angeles metropolitan area through Colton toward the Beaumont Junction of U. S. Highways 60 and 70.

A number of utilities, mostly water lines, had to be re-routed or lowered where they crossed the job. The most difficult of these was a 24-inch irrigation main which leads down from Big Bear Lake and irrigates hundreds of acres of citrus orchards in the Redlands region. The nearest shut-off valve was at Big Bear, at least 15 miles from the job. With bulldozers and carryalls working on nearby excavation, the possibility of an accidental break of this line was so pronounced that Project Manager John Matich decided to locate the line definitely and get it re-routed as soon as possible. It was surveyed and then located by a gang of laborers working with shovels. Once having flagged, the line was undisturbed, where it crossed the highway right of way, until a new re-location could be placed by construction forces. The water was shut off at Big Bear 24 hours in advance of the joining of the new-laid section, and the surplus water drained off through a bypass siphon.

Three bulldozers were used to pioneer the heavy portions of highway cuts where the top of the backslope met the existing ground. As soon as a bench had been opened up wide enough to allow carryall passage, three 30-cubic-yard carryalls were brought in and hooked to the tractors. The cuts through this section consisted of an 8-foot crust of clay, then a 20-foot layer of alluvial conglomerate, turning into sand at the bottom of the cuts.

Excavation work was speeded up considerably by pre-watering the borrow. Water percolated through the conglomerate very satisfactorily, resulting in better loading of carryalls and faster compaction where the borrow was processed in fills. A 25-cubic yard earthmoving scraper with a D-8 prime mover was also brought in and used on tractor excavation.

Freeway relocation of U. S. Highway 99 looking easterly from the City of Redlands. On opposite page—Upper—View at the beginning of the divided highway, showing the Fern Street channelization at grade and new alignment in background. Lower—Typical revision of existing modern two-lane highway to a four-lane highway. Expansion was performed with virtually no loss of investment







New Methods Developed for Joint and Crack Sealing of Concrete Pavements

By H. L. COOPER, Assistant Maintenance Engineer

IT IS generally agreed that the sealing of all joints in concrete pavements is the best insurance, from an economic standpoint, for satisfactory base conditions and that a longer service life for concrete pavements will result.

Proper sealing prevents the entrance of pebbles and fine inert material which in time would fill the joints and decrease the designed allowance for expansion of the concrete and result in spalling or even occasional "blow-ups."

The most serious result of open joints is the tendency for water to collect during rains and penetrate to the subgrade in the joint areas. This applies to joints along the pavement edges, as well as the transverse joints, if both are not properly sealed. This water if allowed to remain starts what is commonly known as "pumping" with subsequent pavement failure.

IMPORTANCE OF JOINT SEALING

The desirability of using a joint sealing material which will provide for continued satisfactory performance of concrete slabs is important. It has been found that various joint fillers of the asphalt type will not effectively seal joints in concrete pavement under all conditions. Some mixtures become brittle in cold weather and do not adhere to the concrete. In warm weather, some materials may become so soft as to flow onto the shoulders or extrude from the crack and be tracked away by traffic.

Several years ago, an asphalt-latex mixture was used to fill joints on new construction. This material contained rubber and was very effective in sealing joints. It retained its ductility within the temperature ranges required and adhered to the walls of the joint as well. The war stopped the use of this material on account of the rubber shortage and it is only recently that it has become available.

Experiments are now under way by Headquarters Laboratory and the Maintenance Department, using various types and combinations of asphalts and commercial rubber synthetic latex products. These tests include use of filler materials to determine the best and most economical materials for use as a joint filler, which will be reasonably ductile within normal temperature ranges, which will remain adhesive to the walls of the joint and will neither become so brittle as to chip out in cold weather nor so soft as to extrude in hot weather.

TWO MIXTURES USED

Until such time as the ideal product is determined, State Maintenance forces are using in general a mixture of 70 percent 31-40 penetration air-blown asphalt and 30 percent SC6 liquid asphalt. For some sections of the State, this mixture has been found to be too brittle and a 60 percent-40 percent mix is more suitable.

Maintenance crews have mixed the two grades in the field in the past with varying degrees of success. In 1946 it was possible for the first time to purchase state specification joint sealing compound in five-gallon cans, already blended. This procedure has resulted in a more uniform and acceptable filler. In a few cases, it has been arranged to purchase the blended material direct from the refinery delivered to the tank truck at the desired temperatures.

Previous to this year, all joints and crack sealing was done with hand pouring cornucopias, the material being heated in the 110-gallon or 165 gallons asphalt kettles. The work was slow and tedious by this method. In 1946, an effort was made to increase the output and decrease the cost of the work by using a full circulating hose and nozzle arrangement connected direct to the hot asphalt supply. The assembly was made up in the Headquarters Shop, using two ¾ inch metallic hoses connected to a ¾ inch nozzle having a long handle, consisting of two sections of pipe and a wheel 10 inches in diameter, mounted ahead of the outlet to carry the weight of the unit.

The nozzles have a quick opening needle valve, operated by means of a ratchet hand throttle from the top of the long handle which permits a steady control of the low flow of asphalt into the joint. This discharge tip has been improved and as now constructed divides the flow into two streams. The smaller stream ahead tends to drive the air out of the joint and the second stream then fills the joint without side splash.

Two of these full circulating assemblies were attached to the rear end of the special 940-gallon heating tank arrangement which had been developed for use on asphalt sub-sealing work. These large units were used in the development work as they were available; however, a 400-gallon asphalt kettle in District VI has been equipped with these nozzles. It appears that use of these kettles instead of the large outfit will be more economical. After a period of trial with the new equipment, it was evident that the mettalic hose arrangement was somewhat unwieldy and even presented some hazard to operators of the equipment as the material must be applied at a temperature of from 350 degrees to 400 degrees Fahrenheit, although pressures used are the minimum required for flow of the material. At these temperatures, a burn could result from casual contact with the hose and if a hose should break and an operator be sprayed with the hot asphalt the burn could be a serious one. Fred Bushling, mechanic in the District VII, then designed a full circulating pipe assembly to replace the hose unit. Swivel joints constructed to operate under high temperatures were used in the assembly to provide for sufficient side movement of the nozzle and allow the operator to follow the joint easily. This assembly is attached to the rear and side of the tank. Whenever work is stopped at the end of the day, a valve is closed at the tank and the pipe assembly disconnected and flushed out with distillate so that it is clean and ready for the new start.

NEW EQUIPMENT

The truck carrying this equipment is operated at a speed of from one and one-half to less than two miles per hour so that the nozzle men can follow along

on foot. However, a seat consisting of a plank and later of bucket type metal seats were soon installed for their convenience.

The center longitudinal joint and the joint along the pavement edge can be filled in one operation with a return trip necessary to fill the opposite pavement edge. During the return trip, the second nozzle is used to fill any sections of the center not completely filled on the first trip. An efficient job of joint sealing is obtained with the equipment operating at a speed of from 1.5 to 1.8 miles per hour. The asphalt is poured at a temperature of from 350 degrees to 400 degrees Fahrenheit. District VII has poured an average of 13½ miles of longitudinal joints per day with a maximum of 19½ miles of longitudinal joints poured on one day.

No improved method has been devised to date to pour the transverse joints and cracks with the above equipment, consequently, all transverse joints are poured by hand with the cornucopias. However, in some cases the work has been expedited by the use of the large heating tank to replenish the supply in the asphalt kettles for the men using the hand pouring pots.

COSTS VARY GREATLY

The costs of filling joints and cracks in concrete pavement vary greatly. This depends upon the extent of cracking, the time that has elapsed since the joints and cracks were last filled, as well as the amount of asphalt required to properly fill them.

Costs this year for filling joints entirely by hand in three districts average about $67.00 per mile for a two lane pavement.

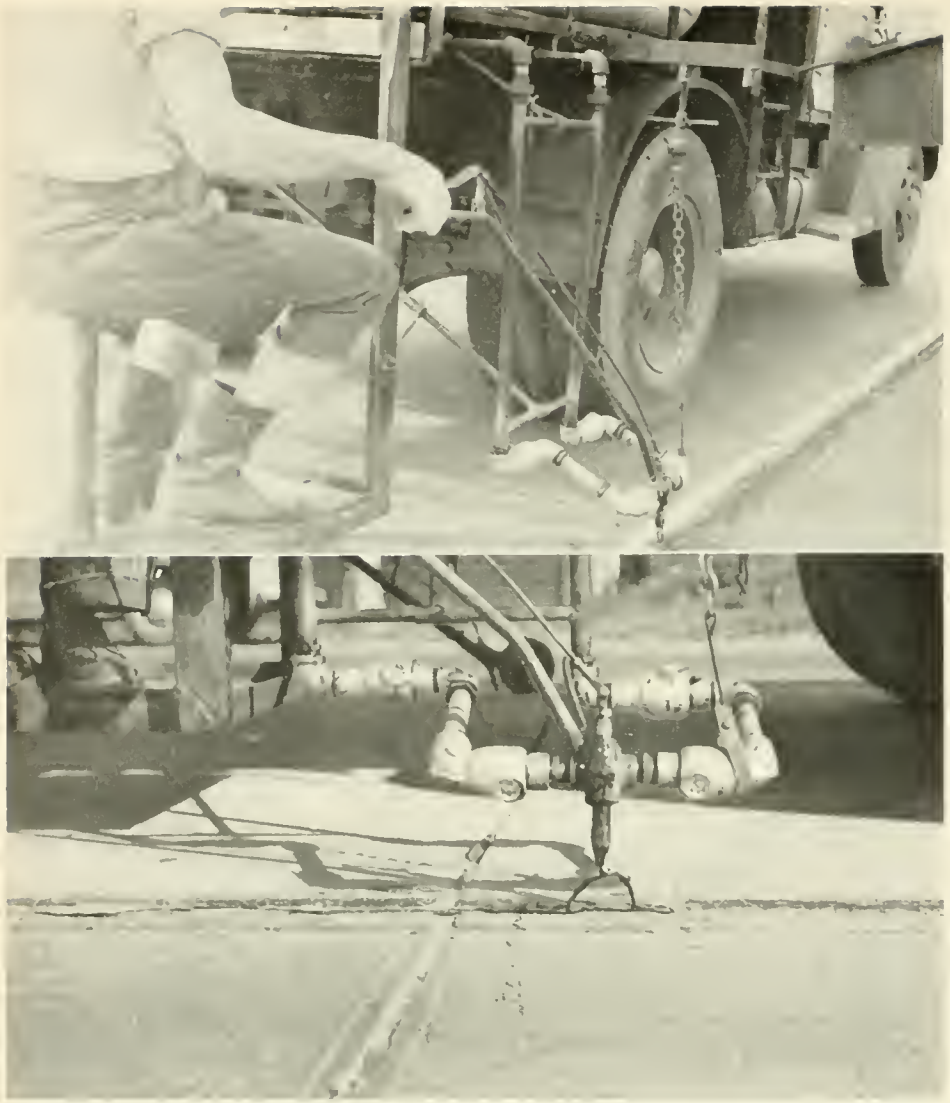
In order to obtain a definite comparison between costs of filling longitudinal joints in a two lane pavement by hand pouring methods as against filling with the large tank and special equipment, costs were kept in two districts. Results showed that filling longitudinal joints only, entirely by hand averaged $14.30 per joint-mile, while the average cost of similar work using the large tank and special equipment was $8.25 per joint-mile, a saving of $6.05 per joint-mile or approximately 42 percent.

SAVINGS ARE EXPECTED

As three longitudinal joints are filled on a two-lane pavement, the savings would amount to about $18 per pavement mile. The finished joint poured



Upper—Using full circulating metal covered hose and nozzle arrangement on 940-gallon tank assemblies for longitudinal joint sealing. Center—Two types of assembly used for joint sealing. Old type in operation on left, new type on right. Lower—Latest improvement of full circulating type assemblies with swivel joints for longitudinal joint sealing



Upper—New type of assembly and nozzle used in joint sealing. Lower—New type of assembly using four swivel type Chikson valve. Note two streams of asphalt from nozzle

by the special nozzle on the large tank also presents a neater and truer line. Moreover, due to the fact that many more joint miles can be poured by the large tank than by hand, the work can be completed during the cold weather when the joints are open the greatest extent and when other conditions are favorable.

Experiments, as indicated earlier in this article, which have been undertaken at various times to determine the advantages of different materials available for joint sealing lead to the belief that a rubber latex compound gives definite promise of giving satisfactory results. This compound at present is very expensive. Furthermore, special equipment such as a machine to cut out and remove the old fillers to a reasonable depth, as well as a special heat controlled machine for its application, are necessary for its use. It may be, therefore, that the use of the latex compound will be too expensive for a time, except possibly on the more important routes.

Steel Operating Rate at High Level

The operating rate of steel companies having 94 per cent of the steel capacity of the industry was 94.4 per cent of capacity for the week ending March 8, compared with 94.4 per cent the week before, 93.4 per cent the month before, and 76.7 per cent one year ago. This represented no change from the preceding week. The week's operating rate was equivalent to 1,651,900 tons of steel ingots and castings, compared to the same figure for the week before.

Public Should Be Awakened to Huge Auto Traffic Toll

SAFETY experts have the proper prescriptions to curb the annual slaughter on our streets and highways, but as yet haven't found a way to overcome public indifference toward their application, according to W. Earl Hall, chairman of the National Committee for Traffic Safety.

"The American public ought to be impressed by the fact that our annual bill for accidents runs into the billions, but most people yawn and say it is no concern of theirs. They have a disease called 'other fellowitis,'" Mr. Hall said.

The safety expert pointed out that during the Christmas holiday season an epidemic of airplane disasters throughout the world brought death to 250 persons. These tragedies, the greatest of which was in far-away China, made the headlines in all the daily newspapers.

"In the same two weeks on the highways of the United States alone—not the world—approximately five times that number of persons met death in traffic accidents," Mr. Hall said. "You probably weren't aware of it. Except in isolated cases, the item didn't get into the newspaper headlines.

"Last summer in Naperville, Ill., a streamlined train telescoped into another streamlined train, bringing death to 47 passengers. For three days that item was banner-lined in every daily newspaper in America.

"During those same three days, almost 300 human beings were killed on the streets and highways of our country. Again, you probably weren't aware of it unless some of the victims were from your family or your neighborhood."

"From Pearl Harbor to V-J Day, Americans killed in battle totaled 261,608; the number of people in the United States killed in all types of accidents in the same period was 355,000—almost 100,000 more killed by mishaps on the homefront than by enemy action abroad.

"Another and even more shocking contrast: The number of wounded in the last war was 651,911. The number of persons in the United States injured in accidents—brace yourself for this figure—was 36,000,000, a ratio of 55 to 1."



This is how the White's Bridge looked after it was wrecked. The 119-foot truss was completely destroyed

Bridge Job Rushed to Eliminate Long Detour

By A. J. STOCKS, Associate Bridge Engineer

WHEN an efficient contractor, with good crew and equipment, and a young resident engineer, with three years experience in the Seabees, team up to get something done in a hurry, quick work is to be expected. Just that occurred in the recent rebuilding of White's Bridge, across Kings Slough, on Route 41, 30 miles west of Fresno.

At about 12.20 p.m., December 20, 1946, the main 119-foot steel truss span collapsed under a truck weighing 14,000 pounds, pulling a tractor on a low-bed trailer, weighing a total of 37,000 pounds, all belonging to Fresno County. This caused a serious disruption to traffic, making immediate replacement imperative.

The bridge was posted for a load limit of eight tons per vehicle or 12 tons per semitrailer combination, so there was definitely an overload. Furthermore, there was a derrick, with 21-foot boom mounted on the rear end of the tractor and, according to Mr. George Hentling, who was waiting in his car at the west end of the bridge for the load to cross, this boom stuck up, caught a lateral strut and appeared to pull the top chords together causing, or contributing to the cause of collapse.

Mr. Henfling went out and flagged traffic until assistance arrived. Mrs. Jessie Seames, working in a small store and restaurant at the east end of the bridge at the time, was attracted by the crash, rowed out and brought the driver ashore. He was standing on the cab of the truck, unhurt, and knee deep in water when rescued.

State Highway Maintenance Forces of District VI, Fresno, were immediately dispatched to the scene. They barricaded the bridge, blocked off that section of road and routed traffic over county roads through Tranquility.

(Continued on page 32)

Looking northeast at White's Bridge following record reconstruction





California Division of Highways Exhibit at San Bernardino National Orange Show

By Budd Hinton, Traffic Department

SAN BERNARDINO'S National Orange Show has easily surpassed its past record of producing one of California's most glittering and colorful expositions. The 287,785 persons attending this thirty-second Orange Show, first since 1941, were amazed at the spectacular color and displays which covered more than five acres of floor space. The designer's ingenuity in creating a most colorful exposition was in character with the beauty of the locale which is set in an amphitheatre of snow covered mountains carpeted by a limitless expanse of orange groves and blossoming trees.

The National Orange Show provided an opportunity for 143 exhibitors to reach a huge collective audience of over a quarter million people. The progress and development of highways is of continuing interest to all citizens who, incidently, are the owners of the highway system

In view of the widespread interest in highway improvements at the present time this exhibit of the Division of Highways has served to present graphically some of the more important factors which enter into consideration of this problem.

This exhibit was necessarily confined to four sections. The first section was designed to point out the fact that "Not So Long Ago" the highway system was attuned to the transition from the horse and buggy to the horseless buggy. Much interest was centered on this panel which featured a collection of photographs taken about 30 years ago, which, to the younger generation, must have appeared to be from the gay 90's era.

The second panel depicted "Increasing Factors" in which comparative photographs, old and recent, point out the increase in various factors such as miles of travel, registrations, fuel consumption, parking needs, construction costs, congestion, commercial use, and traffic increase. A "Transportation Facility to Serve" panel was based on origin-destination of travel in which the highway serves regional, suburban, homes, industry, business, and recreation.



These photographs show sections of the attractive exhibit shown by the State Division of Highways at the San Bernardino National Orange Show, which was attended by over a quarter of a million persons. The Division of Highways now is working on a comprehensive exhibit to be shown at the forthcoming State Fair in Sacramento

The concluding panel, of course, is "Freeways Are Needed Now."

Surmounting the "back of the eight-ball" problem is the freeway design which utilized photographs of existing freeways to emphasize the modernity of some of our highways.

A detailed model in exact scale of the four-level structure to be constructed at the intersection of Arroyo-Seco and Hollywood Freeways in Los Angeles was prominently exhibited.

A plexi-glass model showing Traffic-Flow bands on the State Highway System continues to attract attention wherever shown. It is significant that this technical model has proven to be of such general interest to the lay public.

All of the material for this exhibit was designed and constructed in the Headquarters Office of the State Highway Department. The structure model is now on display in the District Office at Los Angeles, while the traffic flow model is at Sacramento.



Relocation of Roosevelt Highway Is Proceeding at Rapid Rate

RECONSTRUCTION and relocation of five miles of State Highway Route 60, the Roosevelt Highway, from a point north of Malibu Creek, 12 miles north of Santa Monica, to Latigo Canyon along the Los Angeles County shore line, rapidly is being pushed to completion.

The entire project, which is in three units, from westerly of Latigo Canyon to Malibu Creek, when completed, will provide a four-lane divided highway and will eliminate the last remaining portion of the 20-foot pavement on the Coast Highway from its junction with U. S. 101 near Ventura to the end of the route at its junction with U. S. 101 near Doheny Park.

The first unit consists of a line change around the slide area at Latigo Canyon. The second unit covers the relocation of the highway around slide and slipout areas along the existing highway between Corral Creek and Malibu Creek easterly of the section of Roosevelt Highway between Latigo Creek and Corral Creek, which is the third unit.

The construction now under way consists in general of grading a roadbed 80 feet in width and construction thereon of four lanes of Portland Cement concrete pavement, providing two lanes of traffic in each direction. There will be a central division strip four feet in width and the area between the curbs will be planted with ice plant. Bituminous surface treatment is proposed for the shoulders with Class "B-Double" seal coat to be placed over the bituminous surface treatment in the gutter areas on grades of two percent or more. Shore protection will be constructed out of selected riprap material. Additional widths of embankment will be constructed on the ocean side of the highway to provide counterweight through

Concrete drainage culvert under construction in Puerco Canyon as a unit of the relocation of the Roosevelt Highway in Los Angeles County





This view is looking north toward the end of the project involving the relocation of Roosevelt Highway north of Santa Monica

the slide area easterly of Solstice Canyon.

The present alignment parallels the beach through slide areas and contains many curves of short radius. The grade of the present highway is flat throughout, the maximum grade being less than 0.5 percent and the elevation of the existing road being approximately 18 feet.

The new construction provides for a highway on a higher elevation with the exception of a short section near the easterly end of the project, where connection is made to the existing grade across Corrall Creek Bridge.

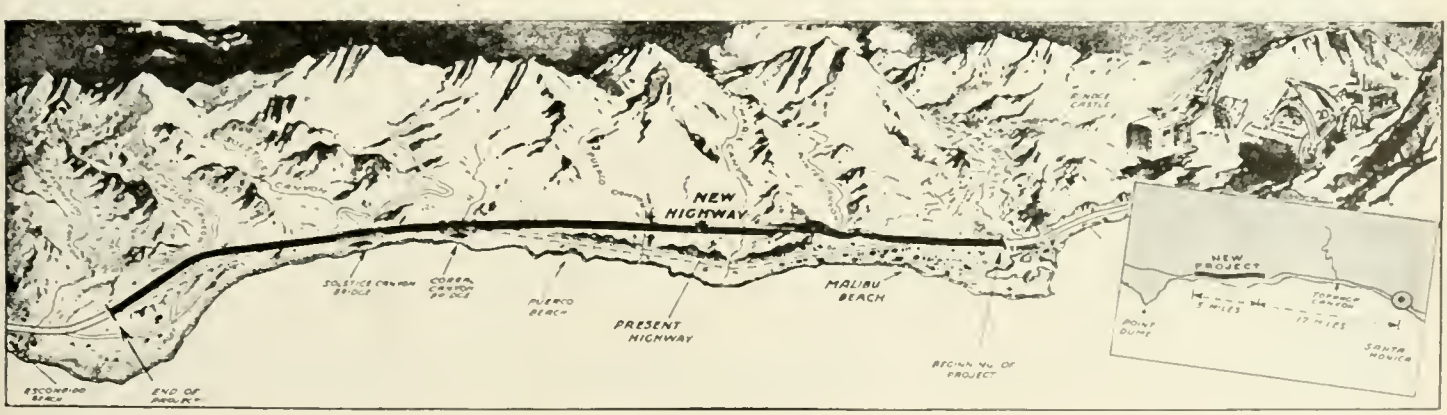
Following the storms of 1941 which caused many slides and slipouts along the existing highway, consideration of reconstruction on the present alignment was abandoned.

The project passes along the front of the bluffs paralleling the ocean and crosses Solstice Canyon near the middle of the project at an elevation of approximately 30 feet above the stream bed.

The present highway, which was completed in 1926, is graded to a minimum width of 40 feet, paved with 20 feet of Portland cement concrete, with oil-mixed shoulders six feet in width, all on an 80-foot right of way.

The only drainage area requiring special design is at Solstice Canyon. The existing bridge across the Canyon was widened in 1938 to provide for four lanes of pavement with a four-foot central division strip. In order to meet the various controls and to stabilize slides and slipouts, it is necessary to raise the grade across Solstice Canyon approximately 20 feet above the existing grade, which in turn requires moving the center line of the new construction landward in order

(Continued on page 28)





This shows new alignment of Roosevelt Highway looking south to its junction with existing route

California Counties Launch Construction of 55 Bridges

(Continued from page 8)

length of 86 feet. Roadway is 26 feet wide.

The county plans to handle construction engineering on this structure.

Approximate cost, including engineering and contingencies____ $15,000

Bids are to be received for two St. Johns River Bridges on April 23d. These structures consist of a series of concrete slab frames 36 and 37 feet long. One structure is 255 feet long and the other 300 feet. Roadway width is 26 feet.

Construction engineering has not yet been decided by the county for these two structures.

Approximate cost, including engineering and contingencies____ $190,000

Plans for the Kings River Bridge are ready for immediate advertisement. This structure is located about five miles northeast of Kingsburg. The structure is 850 feet long and consists of a series of 40-foot concrete girder spans.

The county proposes to handle construction engineering with its engineering forces for this structure.

Approximate cost, including engineering and contingencies____ $235,000

Plans are ready for the early advertisement of a bridge across Tule River located a few miles west of Porterville. Structure is 510 feet long and consists of a series of 40-foot slab frame spans on a 45 degrees skew.

The method of handling construction engineering has not yet been decided by the county.

Approximate cost, including engineering and contingencies____ $130,000

In addition to the above major bridge jobs, the county has five smaller structures ready for advertisement. These structures are across Porter Slough, Deep Creek, Tule River, Outside Creek and Irrigation Canal. These structures are located directly south of Visalia.

Construction engineering for these jobs has not yet been decided on by the county.

Approximate cost, including engineering and contingencies ___ $65,000

YOLO COUNTY

John Roberts, County Engineer, has one project under construction consisting of the extension and improvement to the Cache Creek bridge at Capay.

The other structure under construction consists of a new bridge across Moody Slough located about one mile northeast of Winters. This structure consists of two 24-foot concrete slab frame spans.

The county is handling construction engineering.

Approximate cost, including engineering and contingencies ___ $90,000

YUBA COUNTY

Yuba County has plans ready for early advertisement of two bridges, one across Best Slough and Dry Creek. These bridges are located south of Marysville and about six miles east of Wheatland. They will facilitate the movement of farm produce in this area.

The two bridges are of the reinforced concrete slab type. Construction engineering has not yet been worked out with the county.

Approximate cost, including engineering and contingencies ___ $60,000

Coast Highway Relocated Between Santa Barbara and Elwood Overhead

By J. C. ADAMS, Associate Highway Engineer

THREE jobs recently completed in Santa Barbara County provide 9.3 miles of new two-lane and four-lane modern highway in District V and U. S. Route No. 101, which is the major highway coast route between Los Angeles and San Francisco.

The new construction starts about one mile northerly from the city limits of Santa Barbara and extends to Tecolote Canyon near the so-called Elwood Overhead. It replaces the present route through the town of Goleta between the Hollister Underpass and the Elwood Overhead. The old highway will become a county road.

The right of way was obtained on a limited access freeway basis so that 3.4 miles is of two-lane construction so positioned as to constitute the southbound lanes of the future four-lane divided highway.

Shortly after Pearl Harbor, the United States Navy took over area and facilities that the City of Santa Barbara had been developing as a municipal airport at Goleta for expansion into a Marine Corps air station. Not having been designed to handle the large volume of air traffic involved in its operation as an air training base, it was necessary to expand the airport several fold so that it extended along the Coast Highway from Goleta to Stoney Creek, a distance of about 1½ miles.

This expansion included the development of a warehouse and repair shop area adjacent to the railroad on the easterly side of the highway opposite the airport proper so that in effect, the highway passed through the base. Highway traffic and operation of the base so conflicted with each other that the United States Navy requested relocation of this section of the Coast Highway to a location on the easterly side of the railroad. However, some delay in securing final Navy approval of financing was experienced.

Surveys and preparation of plans were undertaken immediately upon consummation of agreement with the Public Roads Administration covering financing of engineering, right of way and construction costs.

PROJECT IN THREE UNITS

In order to expedite letting of contracts, the project was divided into three units so that each unit might be advertised for bids as soon as the plans for it were completed rather than await completion of plans for the entire project. Subsequently it was decided to let furnishing and installation of the vehicle actuated signals at the Hollister Wye as a fourth separate contract because of the specialized nature of the work and extended delays anticipated in obtaining delivery of required equipment under current condition.

The new construction utilizes a portion of the old road at the Santa Barbara end of the projects, and 0.90 of

Channelization of Hollister Avenue intersection with signal installation in progress





Looking northerly along completed relocation of U.S. 101 in Santa Barbara County

a mile of the new work consists of four lanes divided by a division strip of variable width. Adjacent thereto, local traffic between Santa Barbara and Goleta via Hollister Avenue is routed over an outer road 22 feet wide with 8-foot shoulders.

Acceleration and deceleration lanes are provided to facilitate turning movements to and from Hollister Avenue and to keep their interference with through traffic on U. S. 101 at a minimum.

The new alignment parallels the main coast line of the Southern Pacific Railroad on the easterly side for approximately eight miles.

Near the Elwood Overhead the two lanes become four lanes with a variable to 26-foot width dividing strip, changing to two lanes at connection with the existing U. S. 101. The one-fourth mile section of four-lane divided highway was provided at the Elwood Overhead intersection of the existing highway because of limited sight distances which could be obtained.

The old road contained 17 curves, six of which had radii of less than 1,500 feet, eight curves with less than 3,000 feet and two curves of 400 feet and 575 feet radii respectively.

The old grade line was undulating with grades up to 6 percent and had several sharp summit vertical curves with restricted sight distance.

Excluding the transitions from the new construction at both ends and the transitions from four lanes to two lanes, the new alignment has six curves with radii of 4,500 feet to 20,000 feet.

The grade line has modern design sight distance. The maximum grade is 1.7 percent with the exception of the northerly end where the new grade con-

This view is looking northerly along the new location from San Jose Creek Bridge



forms to the existing 5 percent grade of the old road for 1,000 feet.

THE DESIGN

The native soils consisted of clay and sandy clays with inherent low bearing ratio values.

Imported borrow subbase material having a minimum bearing value ratio of 50 percent was used. The imported borrow was obtained locally and was applied to the roadbed in depths varying from 9 inches to 15 inches.

A nonrigid or flexible type of base supported three inches of plant-mixed surfacing. This supporting base consisted of six inches of untreated commercial gravel having bearing value ratios of 80 percent and 70 percent at 0.10 inch and 0.50 inch penetrations. All bearing ratios were based on California Bearing Ratio Method.

The two lanes of 11 feet and 12 feet were constructed on the standard 1½ percent slope, the crown being one way so as to serve as the southbound lanes of the ultimate four-lane divided highway.

At the Santa Barbara end of the three projects, adjacent to the Hollister Wye, the dividing strips and islands were enclosed by concrete curbs. At locations where the lanes were not edged by concrete curbs, a parting strip 36 feet wide separates the north and southbound traffic lanes.

Ice plant cuttings were planted in the dividing strips and islands.

Soil erosion treatment was applied to the cut and fill slopes and to all areas that had been denuded of a vegetation cover. The denuded or raw areas were not given the standard treatment but were sown with barley seed.

At the Hollister Wye, the traffic flow will be controlled by traffic actuated signals. A fourth contract is now under way for the installation of the signal system and it is believed that this installation will be completed by May 1, 1947.

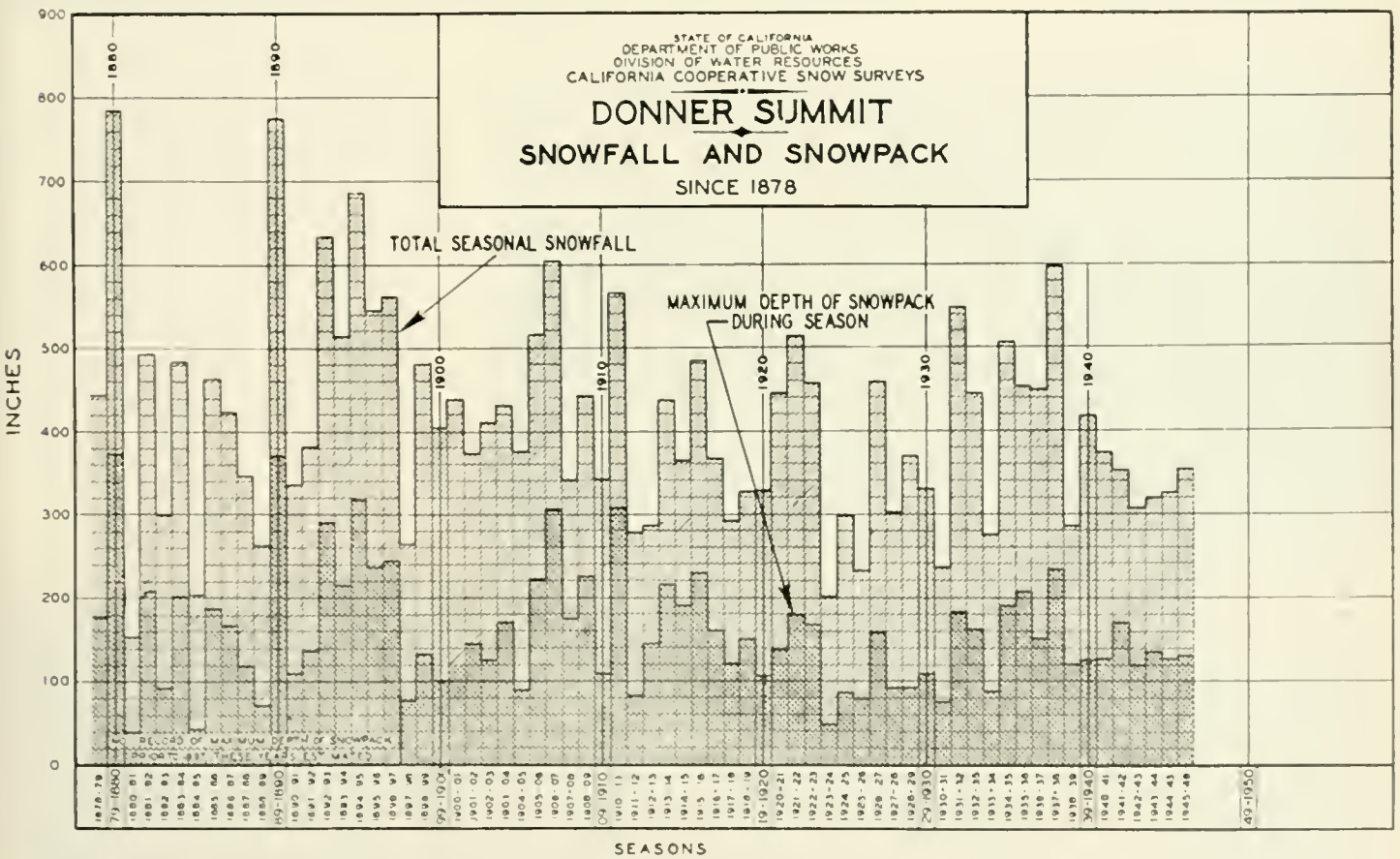
CONSTRUCTION

The new work traverses, in general, the narrow coastal plain lying between the Southern Pacific Railroad and the Los Prietos Range of the Coast Mountains.

Fifteen creeks required concrete structures as follows: Two large bridges of the concrete bent girder type, five small bridges of the double box type, three arch culverts and five standard box culverts.

The existing channels of Maria Ygnacio Creek and Glenn Anne Creek which more or less followed the new alignment were reconstructed by channel changes.

(Continued on page 28)



SNOW removal on U. S. Highway 40 is one of the jobs of the State Highway Maintenance Department. Its giant Sno-gos keep the road over Donner Summit to the East, open all winter, storms or no. In this connection it is interesting to cogitate on the relative intensity of the winters nowadays with the winters of long ago. In the interests of scientific truth the diagram above has been reproduced.

The upper bars of the diagram indicate the total seasonal snowfall at Donner Summit—a total of the amounts recorded daily. The lower cross-hatched portion of the bar indicates the greatest depth of snow measured on the ground at any time during the winter. Thus during the winter of 1937-38 the total snowfall was 597 inches and the deepest reported snow that winter was 234 inches on February 15th.

Bridge Replacements by Culvert and Fill

By M. H. Godwin, Associate Bridge Engineer

FOR MANY years the California Division of Highways has been carrying on a regular replacement program directed at the removal of some rather large and no longer needed structures and their replacement by culverts and fills.

Studies are continually being made to determine the necessity for many of these old and inadequate structures. In recent years, due to compilation of more complete and reliable records, it has been possible to substitute small structures for many of our larger ones, and in some instances, to remove a few of these larger structures entirely.

Based on better records, waterway requirements can be looked into more carefully and consideration then given to the possibility of reducing the size of the structure originally built. When such reductions in waterways can be made, considerable benefits, in the form of reduced first cost and maintenance will result. Improved road standards in the form of line, grade and width will also be obtained.





SMALL BUT IMPORTANT PROJECTS

Considered as individual units, these small projects create no unusual comment and receive little, if any consideration or publicity; yet viewed collectively over a few bienniums, they constitute an appreciable factor in the general over-all picture of improved highway standards and service. They likewise represent a substantial item in reduced maintenance charges.

Costs of such projects are relatively minor, considered as individual units, and they are completed in a short

Table 1 shows roughly what has been accomplished along these lines within the last three bienniums alone, or for the six-year period from July, 1939, through June, 1945.

Period	Number of structures replaced	Costs Total per period	Costs Average per project
July 1939-June 1941	118	$537,000	$4,550
July 1941-June 1943	79	425,000	5,390
July 1943-June 1945	28	180,000	6,420
Six-year period	225	$1,142,000	$5,075





time. This is done without any particular inconvenience to traffic caused by long, expensive and time-consuming detours.

Replacements of some of the larger structures, with small culverts and fills, at times might be the cause of questionable comment from those not familiar with local conditions or the previous history relating to the stream and its characteristics. **Photo No. 1-A** shows a structure before its removal. It was a rather long and narrow bridge on difficult alignment and was posted for restricted loads. **Photo No. 1-B** shows the situation after replacement by a pipe and fill. Elimination was completed at a fraction of the cost that would have been necessary to have replaced the old bridge with a new one of comparable spans.

INCREASED ROADWAY WIDTH

Records over a considerable number of years had demonstrated that the long spans in the old structure were not necessary. This stream carried neither large drift nor any considerable quantity of water, even in the years which were considered as being above normal in rainfall. Benefits obtained are increased roadway width, a considerable improvement in local alignment and complete removal of a severe load restriction. The original structure was built in a locality where timber was a main industry. Furthermore, it was low in cost and easily obtainable in any size or quantity.

Before the advent of rapid and low-cost dirt moving equipment, it was easier and cheaper to bridge these steep ravines with such timber structures than it was to construct heavy fills over concrete or metal culverts. For these reasons, such structures were often originally built even though culverts would have been adequate to carry the flows. Today, such problems are handled in different fashion.

SIDEHILL VIADUCT REPLACED

In some instances, the present necessity for any structure at all has ceased to exist and it can be entirely removed. Such a situation is pictured in **Photo No. 2-A** which shows an old sidehill viaduct built many years ago. A railroad line was located adjacent to the highway, at a tight spot in the topography. This made it necessary to construct the trestle shown in order to gain support for the roadbed at this location. After the railroad ceased operations and removed its tracks, it was possible to bench the highway into the hill, occupy portions of the old railroad alignment and thus completely eliminate the need for any highway structure at this point.

Photo No. 2-B shows conditions after the change had been made. The old viaduct consisted of a series of









short spans for a total length of more than 200 feet. It was very old and weak and entirely inadequate for the heavier vehicles that desired to use this highway. It had been posted for restricted loads and its removal has eliminated not only a restrictive and hazardous structure, but an expensive maintenance problem as well.

CATTLEPASSES REPLACED

Many small structures are found throughout the highway system which were built to accommodate the passing of stock from one side of the road to the other. Such cattlepasses are required by the provisions of the right-of-way agreement and so constructed. Often, the present necessity for such a facility no longer exists and it may be eliminated. When such a structure has deteriorated to a point requiring complete reconstruction, and before any action is taken toward its replacement, the owners are contacted and if they agree the structure is no longer necessary, it is removed. It may be replaced by a fill only, or if conditions require, a small pipe is also installed to take care of local drainage. The removal of structures of this type has been of frequent occurrence during recent years.

Where the structure is still found to be necessary, replacement is made to higher standards and with a more permanent type of construction. **Photos No. 3-A and 3-B** show a small structure, typical of this classification, in the "before" and "after" stages. This small bridge not only acted as a cattlepass but also as a farm road undercrossing. Any number of like replacements have been completed on the entire road system during the last several bienniums with individual projects, attracting little attention beyond that given to them by the parties directly concerned.

CONCRETE ARCH BETTER

Photos No. 4-A and 4B show another typical case, wherein a short span trestle has been replaced by a small concrete arch. A considerably smaller total length of structure has been used to replace the old one, a much higher standard of construction being employed than that used in the original bridge. This, again, is representative of a great deal of work which has been and is now being done along this line.

Photo No. 5-A shows a rather long trestle which has been replaced by the new structure shown in **Photo No. 5-B**. Studies here again pointed to the fact that a much smaller structure could handle the stream flow and it was replaced with the culvert indicated. Again, it is evident that a very material savings was realized in





first cost and maintenance as well as increased benefits obtained in roadway standards. **Photos No. 6-A and 6-B** show yet another typical installation which has been used in a great number of cases with all the attendant benefits noted.

In general, the cost of replacing these small structures is a small part of that which would be required to replace the original bridge to like dimensions and no great expense is required, either in design or construction features, to carry the project to completion. These small costs usually can be taken care of without disturbing the general budget allocations to any material degree.

Installations, to replace these old and inadequate structures, have been made using various types of construction materials, as dictated by the economic requirements of the site. The most common types are metal pipes, both full circle and sectional plate; concrete pipes, boxes and small arches and timber boxes.

It will probably be conceded that money so spent yields as much in improved roadway standards as can be realized in any other lines of highway expenditures.

Future programs are being drawn along these lines which will provide definite sums for this type of work.





Control of Noxious And Pest Weeds Of Importance

CONTROL of noxious and pest weeds growing within the highway right of way is of economic importance to the State. Some of this work is mandatory when ordered by proper authorities, but in any case it is the general policy for Division of Highways forces to cooperate with owners of adjoining property or with local authorities in any campaign for control of weed infestations.

In several counties agreements have been entered into with the county agricultural commissioners, and county forces did the work at state expense. In this way the program is coordinated with similar control on adjoining lands and county roads with mutual satisfaction.

Contact is maintained with state and federal authorities and every effort is made to keep advised of the need of as well as new methods of control, looking toward improvement of the service. Expenditures for this type of work approximated $37,200 during the last biennium.

Coast Highway Relocated In Santa Barbara

(Continued from page 23)

Work was begun on the first unit in October 10, 1945, and completed on January 17, 1947. This job extended between Tecolote Creek and Fairview Avenue.

On January 23, 1946, work was started on the second unit which extended between Fairview Avenue and More Road. This unit was completed on March 11, 1947.

The third unit, extending between More Road and the Hope Ranch Road, was started on July 24, 1946, and completed on March 19, 1947.

The work on the three units consisted of the excavation of 790,000 cubic yards of roadway material, 7,690,000 station yards overhaul, 106,000 cubic yards imported borrow, 57,500 tons untreated gravel base, 45,000 tons of plant-mixed surfacing, 2,700 cubic yards of Portland cement concrete for structures and 227 tons of bar reinforcing steel.

Soil erosion treatment was applied to 78,000 square yards of cut and fill slopes. There were 54 tons of straw and 2¼ tons of western rye grass seed used in this work.

The total cost of the work, including the installation of the signal system at the Hollister Wye, was $1,214,000.

Dimmitt and Taylor were the contractors on the westerly two units and Jesse Smith was contractor on the Hollister Wye unit.

Relocation of Roosevelt Highway Is Proceeding At Rapid Rate

(Continued from page 19)

to reduce to a minimum the amount of shore protection required. In meeting these controls the present bridge cannot be utilized and will be replaced with a new structure.

On one section the new alignment crossses a slide which was active in the spring of 1941. This slide area is composed of clay material which tends to flow rather than slide. A sand drain is being installed to reduce saturation of the original ground.

The new highway, which is being constructed under the supervision of S. V. Cortelyou, District Engineer of the Division of Highways (and Frank B. Cressy, District Construction Engineer), will break a serious traffic bottleneck. E. L. Seitz is the Resident Engineer. Peter Kiewit Sons Company is the Contractor. The project will cost $1,652,000.

In Memoriam

Carl Nelson

Carl Nelson, Highway Maintenance Superintendent of the Division of Highways with headquarters at Visalia in District VI, died suddenly on February 28, 1947. His passing was as he would have wished, while on his regular round of duty near Visalia.

Rich in variety of colorful experience, his had been a full life.

Mr. Nelson was born in Malmo, Sweden, March 11, 1881, and followed his two older brothers to the United States in 1900. He was naturalized a United States citizen in San Diego in 1910.

Carl worked his first three years in the United States with his older brother in a pattern making shop in Seattle, Washington; after this he attended a business school in Topeka, Kansas; he then attended Northwestern University. His first schooling in Sweden included apprenticeship in butter and cheese making.

After finishing his schooling in the United States he went into the creamery business which covered a span of his life from 1905 to 1914. During this time he won several national prizes in the art of butter and cheese making, and also in the planning and construction af creameries in the San Joaquin Valley, which are still in aperation.

Carl often told stories about his experiences in the fire and earthquake af 1906 in San Francisco.

Mr. Nelson had been with the Divisian of Highways since December 19, 1916, with the exception of 18 months during the first world war, when he was working in a ship building yard in the Bay area, and in 1923 when he was farming in Mariposa County. He started with the Highway Department as a carpenter and worked his way up to maintenance superintendent, which position he held from October, 1928, to the time of his death.

Mr. and Mrs. Nelson were married in Visalia, July 4, 1911. He is survived by his widau Mrs. Dollie Nelson; two daughters, Mrs. Elizabeth Mantersino of Merced, Mrs. Dottie Martin of Berkeley; and faur sons, C. Alvin Nelsan of Bakersfield, Dennis Nelson of the United States Navy and Alfred and Floyd Nelson of Visalia.

As a conscientious and capable superintendent, the Division of Highways has sustained a great loss in the death af Carl Nelson. His many friends will miss him.

Articles on the Missions Will Be Off the Press Soon

CALIFORNIA Highways and Public Works continues to receive many requests for back isues of the magazine containing the articles on California Missions. The supply of these issues has been exhausted. The mission stories, with a foreword by Governor Earl Warren, are being published in brochure form by the California Mission Trails Association, Ltd., a nonprofit organization, and will be off the press May 1st.

Those desiring the brochure may write to Mr. Ray Hewitt, General Manager, Mission Trails Association, Ltd., 520 West Sixth Street, Los Angeles 14, California.

Controlled Settlement of Steel Transmission Towers By Use of Explosives

(Continued from page 9)

Immediately following the detonation, measurements indicated that the east tower had settled 0.02 foot, the center tower 0.01 foot and the west tower 0.00. Two days later the east tower had settled 0.21 foot, the center tower 0.15 foot and the west tower 0.07 foot.

In short, the differential settlement between the east tower and the west tower had been reduced by about 0.13 foot as a direct result of the explosive charge.

Two subsequent charges were detonated after further surcharge embankment had been added to within four feet of the planned height and further unequal settlement had exceeded the three-inch limit. Additional settlement of towers by this method, however, proved to be progressively less effective, probably due to the inability to jet additional material from beneath the footings.

The writer and F. B. Cressy, District Construction Engineer, and W. D. Eaton, Resident Engineer, are in charge of this project for the State.

Highway Bids and Contract Awards for February and March, 1947

February, 1947

GLENN COUNTY—Across East Branch Rasor Slough and across Sacramento River near Butte City, a bridge and portions of a bridge to be constructed and about 0.6 mile of approaches to be graded and bituminous surface treatment applied. District III, Route 45, Sections B, C. Lord & Bishop, Sacramento, $385,356.50; E. B. Bishop, Orland, $146,335.70; Guy F. Atkinson Company, South San Francisco; $512,135.10. Contract awarded to Johnson Western Co., Alameda, $359,150.60.

LOS ANGELES COUNTY—On Santa Ana Parkway between Kearney and Soto Streets, about 1.5 miles to be planted. District VII, Route 2. Contract awarded to Jannock Nurseries, Altadena, $66,011.80.

LOS ANGELES COUNTY—At the intersections of Sepulveda Blvd. with Center Street and Gould Lane in the cities of Manhattan Beach and Hermosa Beach, traffic signal systems to be furnished and installed. District VII, Routes 60, 175. C. D. Draucker Co., Los Angeles, $24,845. Contract awarded to Econolite Corp., Los Angeles, $24,719.

MARIN COUNTY—An undercrossing on Linden Lane, under the tracks of the Northwestern Pacific Railroad and the freeway in San Rafael, to be constructed, and about 0.15 mile to be graded and surfaced with Portland cement concrete, crusher run base, and plant-mixed surfacing. District IV, Route 1. Carl N. Swenson Co., San Jose, $239,230.85; Dan Caputo & Edward Keeble, San Jose, $268,186.50; Chas. L. Harney, San Francisco, $282,239.25; Guy F. Atkinson Co., South San Francisco, $311,565.50. Contract awarded to Parish Bros., Benicia, $234,826.90.

SAN DIEGO COUNTY—Between 0.9 mile east of Santa Ysabel and 2.4 miles west of Julian, about 1.3 miles, portions to be graded and bituminous surface treatment applied. District XI, Route 78, Sections B, C. Warren Southwest Inc. & C. G. Willis Sons, Inc., Los Angeles, $117,022.88; Shea & Fisher, Inc., Indio, $139,018; Macco Corp., Clearwater, $147,323.90; Spencer Webb Co., Inglewood, $153,291; Vinnell Co., Alhambra, $169,803.55; Clyde W. Wood, Inc., North Hollywood, $196,169; Griffith Co., Los Angeles, $202,413; Daley Corp., San Diego, $203,929.90; R. E. Hazard Contracting Co., San Diego, $209,198.80. Contract awarded to Clifford C. Bong & Co., Arcadia, $113,813.55.

SAN MATEO COUNTY—On Bayshore Freeway, between South San Francisco and Burlingame, substructures for four overcrossings to be constructed. District IV, Route 68, Section F, Burl. Healy Tibbitts Construction Co., San Francisco, $388,895.45; Dan Caputo & Edward Keeble, San Jose, $404,408.36; Parish Bros. & Lew Jones Construction Co., Benicia, $405,312; Butte Construction Co., & Hass & Rothschild Construction Co., San Francisco, $425,209.54; Barrett & Hilp, San Francisco, $426,513.80; Macco Corp. & Morrison Knudsen Co. Inc., San Bruno, $427,144.20; M & K Corp., San Francisco, $433,790.54; Carl N. Swenson Co., San Jose, $458,232.20; Harry J. Oser & Peter Sorensen, Redwood City, $463,329.50; Guy F. Atkinson Co., South San Francisco, $465,545.10; Chas. L. Harney, San Francisco, $486,987.72; Underground Construction Co., Oakland, $497,943.66; Clinton Construction Co., San Francisco, $524,021.01; Stolte Inc. & The Duncanson Harrelson Co., San Francisco, $595,837.60; Contract awarded to Carrico & Gautier, San Francisco, $378,653.30.

SANTA CLARA COUNTY—On Bayshore Freeway at Santa Clara Street Underpass in the City of San Jose, about 0.5 mile to be planted and a sprinkler system to be furnished and installed. District IV, Routes 68, 2. Leonard Coates Nurseries, Inc., San Jose, $14,018.12; Tyson & Watters Co., Sacramento, $25,169.50; Bay Nursery, San Mateo, $39,471.40. Contract awarded to Huettig & Schromm, Palo Alto, $13,072.35.

SHASTA COUNTY—The substructure for a bridge across the Sacramento River to be constructed. District II, Route 20, Section C. John C. Gist, Sacramento, $318,340; Lord Bishop, Sacramento, $335,731; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $348,925; Macco Corp, Clearwater, $367,740; Guy F. Atkinson Co., South San Francisco, $368,697; Johnson Western Co., Alameda, $374,419; E. B. Bishop, Orland, $387,783; George Pollock Co., Sacramento, $446,669; Pacific Bridge Company, San Francisco, $465,835. Contract awarded to James I Barnes Construction Co., Santa Monica, $317,106.

March, 1947

BUTTE COUNTY—Across South Fork Feather River at Bidwell Bar a reinforced concrete girder bridge to be constructed. District III, Route 104G, E. H. Peterson & Son, Richmond, $123,582.70. Contract awarded to Dey Contracting Co., Menlo Park, $94,394.

CONTRA COSTA AND SOLANO COUNTIES—Construction of maintenance railings, ladders and platforms on the Carquinez Bridge. District X, Route 7, Sections A,F. Herrick Iron Works, Oakland, $30,240; William B. Willett Co., San Francisco, $40,105; Westco Steel Fabricators, Inc., Oakland, $49,938; E. H. Peterson & Son, San Pablo, $57,118; Moore Dry Dock Company, Oakland, $59,186; Schrader Iron Works, Inc., San Francisco, $61,420. Contract awarded to Minton & Kulson, San Francisco, $23,904.

HUMBOLDT COUNTY—On Elk River Road, between junction with State Route 1 south of Eureka and Elk River School, about 2.2 miles in length to be graded and a Class "B-Single" seal coat applied. District 1, Route 970. Browne & Krull, Palo Alto, $60,412.75; W. C. Railing, Redwood City, $61,421.72; John Burman & Sons, Eureka, $67,031.50. Contract awarded to Mercer Fraser Co., Eureka, $59,983.

HUMBOLDT COUNTY—Between 1.2 miles east of Korbel Road and 2.7 miles east of Redwood Summit, portions about 10 miles in length, imported base material to be furnished and placed and at various locations sand and screenings to be furnished and stockpiled. District 1, Route 20, Section B. Fairey-Hammond, Inc., and R. A. Farish, San Francisco, $99,925; Mercer, Fraser Company, Eureka, $105,625. Contract awarded to W. C. Railing, Redwood City, $98,320.

MENDOCINO COUNTY—On Longvale-Covelo Road, between 1.5 miles easterly and 5.4 miles easterly of Dos Rios, about 2.9 miles, to be graded. District 1, Route 505. John Burman and Sons, Eureka, $172,033; H. Earl Parker, Marysville, $205,032.75; A. R. McEwen and C. M. Syar, Willits, $209,179; Morrison Knudsen Co., Inc., San Francisco, $236,057.50; Eaton & Smith, San Francisco, $236,372; Louis Biasotti & Son, Stockton, $245,827.55; Fredrickson & Watson Construction Co., Oakland, $324,237.50; Fredrickson Bros., Emeryville, $328,463.95; Piombo Construction Company, San Francisco, $344,919.40. Contract awarded to N. M. Ball Sons, Berkeley, $170,927.80.

NAPA AND LAKE COUNTIES—Between one-tenth mile southerly and 1.5 miles northerly of the Napa-Lake County line, portions only, about 0.8 mile in length, to be graded, road mixed surfacing to be placed and two bridges to be constructed. District 1, Route 39, Sections A,A. Parish Bros. & Lew Jones Construction Co., Benicia, $225,733.40; C. M. Syar & A. R. McEwen, Geo. M. Carr and Battista Rocca, Vallejo, $221,841; A. Soda & Son, Oakland, $224,661.84; Fredrickson & Watson Construction Co., Oakland, $221,351.05; Fredrickson Bros., Emeryville, $247,239.40; Guy F. Atkinson Company, South San Francisco, $282,402. Contract awarded to Piombo Construction Company, San Francisco, $218,280.10.

LOS ANGELES COUNTY—On Santa Ana Parkway at Soto Street, in the City of Los Angeles, a reinforced concrete box girder undercrossing to be constructed. District VII, Route 2, Oberg & Cook, Los Angeles, $198,220; W. J. Disteli, Los Angeles, $201,911.50; Haddock Co., Pasadena, $210,130.50; Byerts & Dunn, Los Angeles, $214,759; Carlo Bongiovanni, North Hollywood, $244,557; The Contracting Engineers Co., Los Angeles, $225,863; Guy F. Atkinson Co., Long Beach, $228,759; Johnson Western Co., San Pedro, $256,294. Contract awarded to Oberg Bros., Inglewood, $195,333.

LOS ANGELES COUNTY — Between Palomas Creek and Violin Saddle, about 2.6 miles, to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 4, Section G. A. Teichert & Son, Inc., Sacramento, $834,593; C. G. Willis & Sons, Los Angeles, $911,282; James I Barnes Construction Co., Santa Monica, $934,050.10; Ralph A. Bell & A. F. Heinze, Alhambra, $995,112.50; Morrison-Knudsen Co., Inc., Los Angeles, $1,026,021.25; Bressi & Bevanda Constructors, Inc., Los Angeles, $1,030,889.25; Vinnell Co., Alhambra, $1,034,201; N. M. Ball Sons, Berkeley, $1,083,228.50. Contract awarded to Claude W. Wood, Inc., North Hollywood, $763,297.50.

LOS ANGELES COUNTY—At 11 intersections on Elena Avenue and El Camino Real in the cities of Redondo Beach and Hermosa Beach, traffic signal systems to be furnished and installed. District VII, Route 60. Econolite Corp., Los Angeles, $50,098. Contract awarded to C. D. Draucker Co., Los Angeles, $46,805.

LOS ANGELES COUNTY—In the City of Los Angeles, on Arroyo Seco Parkway, between College Street and Bernard Street, about 0.3 mile in length, trees, shrubs, and ground cover to be furnished and planted. District VII, Route 165. Contract awarded to Jannock Nurseries, Altadena, $10,914.25.

ORANGE COUNTY—Near Irvine about 6 miles south of Trustin, two culverts to be constructed. District VII, Route 2, Section B. O'Brien & Bell Construction Co., Santa Ana, $55,492.50; Walter H. Barber, La Mesa, $58,643; Oberg & Cook, Gardena, $58,659; E. G. Perham, Los Angeles, $59,490; Vido Kovacevich Co., South Gate, $59,952.50; O. H. Pierson, Bellflower, $60,690; C. B. Tuttle Co., Long Beach, $61,530; Clifford C. Bong & Co., Arcadia, $67,258.50; Haddock Engrs., Ltd., Oceanside, $77,080; E. S. & N. S. Johnson, Fullerton, $78,424. Contract awarded to Catalina Construction Co., Covina $48,554.20.

PLACER COUNTY—Between Wise Canal and Rock Creek, about 1.9 miles to be graded and surfaced with crusher run base and plant-mixed surfacing, an underpass to be constructed and an existing bridge to be widened. District III, Route 17, Section C. N. M. Ball Sons & H. W. Ruby, Berkeley, $237,419.45. Contract awarded to Fredrickson & Watson Construction Co., Oakland, $230,694.80.

RIVERSIDE COUNTY—On "B" Street and Crestmore Road, between State Highway, Route 19 in West Riverside and San Bernardino County line, about 2.9 miles to be graded and surfaced with Portland cement concrete pavement and plant-mixed surfacing. District VIII, Route 706. Matich Bros., Colton, $120,011.50; Griffith Co., Los Angeles, $137,266.10. Contract awarded to E. L. Yeager, Riverside, $104,799.

RIVERSIDE COUNTY—Between Mira Loma and 2½ miles west of Riverside, 5.9 miles, seal coat to be furnished and applied. District VIII, Route 19, Section A. Matich Bros., Colton, $9,685.50; Vinnell Co., Alhambra, $10,682.50; A. A. Veit, Tujunga, $11,603; Pacific Pipe Line Construction Co. and Engineers, Ltd., Los Angeles, $10,751.50. Contract awarded to Geo. Herz & Co., San Bernardino, $8,525.70.

SACRAMENTO COUNTY—On Howe Avenue between Fair Oaks Blvd. and Arden Way, about 1.6 miles to be graded and surfaced with crusher run base on imported borrow; and the existing pavement to be widened with crusher run base and surfaced with plant-mixed surfacing. District III, Route 937. A. Teichert & Son, Inc., Sacramento, $59,516.85; McGillivray Construction Co., Sacramento, $64,213; Harms Bros., Sacramento, $69,302.75; C. M. Syar, Vallejo, $71,905.75; J. R. Reeves, Sacramento, $72,402.70; Browne & Krull, Palo Alto, $73,859.50. Contract awarded to Westbrook & Pope, Sacramento, $47,828.50.

SAN DIEGO COUNTY—Over Switzer Canyon in the City of San Diego, a portion of an overhead crossing to be repaired. District XI, Route 2. Johnson Western Co., Coronado, $44,949; Oberg & Cook, Los Angeles, $45,424; Carroll & Foster, San Diego, $58,840; M. H. Golden Construction Co., San Diego, $67,270.40. Contract awarded to C. B. Tuttle Co., Long Beach, $44,333.60.

SAN JOAQUIN COUNTY—At Calaveras River about 8 miles north of Stockton about 0.4 mile to be graded and surfaced with plant-mixed surfacing, and a steel girder bridge to be constructed. District X, Route 97, Section A. Northup Construction Co., Long Beach, $74,466.50; Louis Biasotti & Son, Stockton, $76,181; Stockton Construction Co., Stockton, $76,459; Claude C. Wood Co., Lodi, $77,129.50; Dan Capurro & Edward Keeble, San Jose, $81,865.60; M. J. B. Construction Co., Stockton, $86,822; Charles MacClosky Company, San Francisco, $88,797. Contract awarded Elmer J. Warner, Stockton, $73,631.50.

SAN BERNARDINO COUNTY—Between 1 mile east of Victorville, and Victorville, about 1.4 miles to be graded and bituminous surface treatment to be applied. District VIII, Route 43, Section L. Clifford C. Bong & Co., Arcadia, $96,183.70; T. M. Page, Monrovia, $97,793; Silva & Hill Construction Co., Los Angeles, $104,358.40; Vinnell Co., Alhambra, $107,248.30; A. F. Heinze, Alhambra, $116,791; Mike Radich & Co., Burbank, $118,184; C. G. Willis & Sons, Los Angeles, $119,174.92; George Herz & Co., San Bernardino, $139,434.90. Contract awarded to Matich Bros., Colton, $94,486.

SAN BENITO COUNTY—Between 2.5 miles south of Hollister and Hollister, about 2.6 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Route 119, Section E. Clements & Co., and Edward Keeble, San Jose, $147,718.50; Fairey-Hammond Inc. and R. A. Farish, San Francisco, $161,904; Granite Construction Co., Watsonville, $163,281; Ted F. Baun, Fresno, $174,911; A. A. Edmondson, Glendale, $177,367.15; A. Madonna, San Luis Obispo, $177,518.80. Contract awarded to A. Teichert & Son, Inc., Sacramento, $137,527.50.

SAN BERNARDINO COUNTY—From 11 miles east of Needles to Red Rock Bridge, about 2.9 miles to be graded and surfaced with bituminous surface treatment. District VIII, Route 58, Section P. A. A. Edmondson, Glendale, $77,688.26; T. M. Page, Monrovia, $80,652; Jesse S. Smith, Glendale, $83,113; Dimmitt & Taylor, Los Angeles, $88,133.80; Herz Paving Co., San Bernardino, $88,329.40; Vinnell Co., Alhambra, $89,737; MacArthur & Son, Palmdale, $95,482; Warren Southwest Inc., Los Angeles, $103,297. Contract awarded to Arthur A. Johnson, Laguna Beach, $65,237.

SANTA BARBARA COUNTY—Over the tracks of the Southern Pacific Company at Salsipuedes Street in the City of Santa Barbara, the substructure for an overhead crossing to be constructed. District V, Route 2. C. B. Tuttle Co., Long Beach, $238,816.90; R. M. Price Co., Huntington Park, $241,178.50; Carl N. Swenson Co., San Jose, $242,133.05; John C. Gist, Sacramento, $264,453.50; Johnson Western Co., San Pedro, $279,728.45; Winston Bros. Company, Los Angeles, $289,838.50; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $307,702. Contract awarded to Macco Corporation, Clearwater, $231,305.50.

SANTA CLARA COUNTY—On North Fourth Street, between Route 68 and San Jose, about 1.2 miles to be graded and paved with asphalt concrete. District IV, Route 159. A. J. Raisch Paving Co., San Jose, $65,804.10; Union Paving Co., San Francisco, $78,692; Edward Keeble, San Jose, $78,273. Contract awarded to Piazza & Huntley, San Jose, $63,558.50.

TULARE COUNTY—Across White River Sink, about 2 miles south of Earlimart, a bridge and approaches to be constructed. District VI, Route 4, Section A. Thorsten & Dahl, Santa Monica, $36,205; Griffith Company, Los Angeles, $37,304.25. Contract awarded to Wheller Construction Co., Oakland, $29,324.

SACRAMENTO COUNTY—Across Arcade Creek on Madison Avenue, about 10 miles northeast of Sacramento, a reinforced concrete slab bridge to be constructed. District III, Route 537. Chittenden & Chittenden, Auburn, $21,534.25; G. M. Carr & Bati Rocca, Santa Rosa, $22,975; Wheeler Construction Co., Oakland, $24,389; A. L. Miller, Sacramento, $27,705; Charles MacClosky Co., San Francisco, $31,645. Contract awarded to Wm. E. Thomas Construction Co., Sacramento, $18,713.

TULARE COUNTY—At Yokohl Creek, about 4 miles north of Exeter, a steel beam span bridge to be constructed and approaches to be graded and surfaced. District VI, Route 129, Section E. Charles MacClosky Co., San Francisco, $114,783. Contract awarded to R. M. Price Co., Huntington Park, $92,921.

TULARE COUNTY—Between Packwood Creek and Route 10, about 2.3 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District VI, Route 132, Section A,Vis. Ted F. Baun, Fresno, $229,389; Brown-Doko, Pismo Beach, $238,429.50; Fairey Hammond, Inc. and R. A. Farish, San Francisco, $239,736. Contract awarded to R. M. Price Co., Huntington Park, $226,365.50.

YOLO COUNTY—Across Moody Slough about 2 miles northeast of Winters and at Cache Creek about 0.2 mile north of Capay, a reinforced concrete slab bridge to be constructed and an existing reinforced concrete bridge to be reconstructed. District III, Routes 1154 and 1152. Charles MacClosky Company, San Francisco, $113,744. Contract awarded to Chittenden & Chittenden, Auburn, $70,493.75.

VENTURA COUNTY—At intersection of Ventura Blvd. and Telephone Road, intersection illumination to be furnished and installed and at intersection of Ventura Blvd. and Telegraph Road, traffic signals and intersection illumination to be furnished and installed. District VII, Routes 2, 9, 79, Sections C,A, Ven. Econolite Corp., Los Angeles, $40,438; C. D. Draucker Co., Los Angeles, $41,705. Contract awarded to L. H. Leonardi Electrical Construction Co., San Rafael, $34,914.

New Deflector Barrier Gives Added Safety

AN EXPERIMENTAL concrete deflector barrier has recently replaced a section of metal barrier wall on the hazardous Grapevine grade on U. S. 99 in Kern County, approximately halfway between Fort Tejon and Grapevine Station. A concrete barrier was selected in an attempt to reduce high maintenance costs of the former metal rail as well as to provide additional assurance against head-on collisions.

The 4.9-mile-long, 6 percent Grapevine grade has been the site of a number of accidents. The volume of traffic on this section of highway averages 7,000 vehicles per day; of these 1,000 are trucks, a large proportion of which approach the legal maximum.

Division between the north and southbound lanes was formerly provided by guard rails of metal and wood and a division strip. However, these barriers failed to prevent heavy runaway trucks coming down the steep grade from crossing over into the opposing stream of traffic.

Speeding trucks or those out of control habitually used the former guard rail as a rubbing strip to reduce speed. This constant scuffing and rubbing was extremely detrimental to the rail and, consequently, maintenance and replacement costs were excessive. The new barrier is designed so that trucks cannot rub against it; the parabolic base repels truck wheels from the barrier without permitting rubbing action.

The new concrete dividing barrier is constructed of precast units 10 feet long and weighing approximately 3000 pounds. The total length of barrier constructed for the experimental project was almost 2,000 feet at a cost of $20,000. Since the barrier which was completed October, 1946, has been in place a relatively short time, it has not been possible to arrive at any definite conclusions regarding its merits. However there have been no fatalities recorded since its installation and relatively few scars as a result of impact are evident to date.



Two views of new concrete center barrier for traffic protection on Ridge Route section of U.S. 99

Record Made on Bridge Job

(Continued from page 15)

The length of this detour was 37.8 miles, leaving Route 41 eight miles east of the bridge and rejoining it at the north city limits of Mendota. The distance between the same two points via State Highway Route 41 is 11.9 miles. Thus the increased distance over the detour was 25.9 miles, and the consequent inconvenience to traffic is obvious.

A survey of the damage showed the twisted wreckage of the main span snarled up with old pile stumps and trash in 18 feet of water. Its piers were tipped and damaged to an extent which rendered them unsafe for reuse.

The deck of the four west approach spans had been pulled 18 inches east. It had been pulled off of the west bridge seat and the steel caps had slid along on their supports. One cap was just hanging on one corner of its support and looked as if it would drop off into the water at the slightest jar, carrying all with it.

The floor system of the four east approach spans was displaced in a like manner, though not to so great an extent.

It was only intended to use this bridge and adjacent road as a state highway for about three more years. By that time it was planned to have it replaced by a new bridge, about 500 feet northeast of the present structure, on new alignment and built to modern standards of construction. Consequently, it was decided to restore the structure only to its original width and of sufficient strength to carry legal loads, by the quickest and least expensive practical means.

The Bridge Department in Sacramento started at once to draw plans, write the contract and specifications, locate materials and contact contractors who might be interested in bidding on the work. The contract was advertised January 2, 1947, just 13 days after the accident.

During this time interval, materials were located in stock at various state highway maintenance yards. Bridge timbers and flooring were at Walnut Creek, Contra Costa County; railing and wheel guard at Rio Vista and creosoted piles at Hollis Street, Oakland. Transportation of materials to the job was made part of the contract.

Contractors were busy and reluctant to bid on a relatively small job that promised so much grief. It took quite a thorough canvass of contractors to locate any bidders.

Lord & Bishop of Sacramento submitted the low bid—$17,600. The contract was awarded to them January 8th. They were given 21 working days in which to complete the job, making the contract date for completion, February 10, 1947. Mr. Harry Lord, one of the partners, assumed active superintendence of the job. He got his crew together, moved equipment and supplies to the job and was set up ready to go in five days. Mr. T. J. Dunn, Associate Highway Engineer, was assigned the duties of Resident Engineer. Work started January 13, 1947.

What appeared difficult at first—getting the end spans back into place—was done with ease. They were partially lifted by a 15-ton truck crane and slid back by two 30-ton pull jacks.

West approach spans were back in place by noon of the second day, January 14th. Then it took until the following morning to move, via detour, around to the other end of the job, just 250 feet away. It was then but a matter of a few hours to lift and slide the east approach spans back into place. After that, the crane could go out on them, work from them and tackle the job of removing the wrecked main steel span.

The original plan was to partially sink some steel pontoons, slip them under the old span, unwater them and float it. It could then have been towed clear and dismantled at leisure while the work of reconstruction was in progress. Early in this operation, however, the timber floor became unfastened from the steel work and floated to the surface. With this loss of buoyancy, this scheme could not be made to work.

The floating timber floor was easily removed, and when out of the way, the steel skeleton was no hindrance to pile driving. The crane was then equipped with a 3,000-pound drop hammer operating in swinging leads from the end of the boom.

COMPLETED IN 17 DAYS

Fifty-four foot creosoted Douglas fir piles were driven. Then, by the same piece of equipment, caps, stringers and flooring were, in turn, hoisted into place and spiked by the crew. The crane thus traveled out over completed bridge as the work progressed.

The old span was then dismanteled and taken out in pieces, by the crane operating from the completed trestle.

By Wednesday, January 29th, all work was completed except for asphalt surfacing, some bolting of the railings and miscellaneous cleanup. Most of the old span had been hauled off the job.

At noon, January 29th, the District VI Maintenance Crew started placing the asphalt surfacing. By five o'clock that afternoon, January 29, 1947, 12 days ahead of schedule, all work was completed and the bridge opened to traffic.

Total construction time—17 days.

Total time bridge out of service—40 days, 5 hours.

Total cost of contract plus state furnished materials—$23,000.

Expressways Save On Consumption Of Gasoline

POSITIVE evidence that the 50-000 motorists who daily travel the Arroyo Seco Parkway between Los Angeles and Pasadena save a half-gallon of gasoline in each 20 miles of driving by using the high-speed expressway in preference to existing surface streets has been demonstrated in an engineering study conducted by the Automobile Club of Southern California. The tests were carried out over two driving runs—one on the Arroyo Seco Parkway and the other on a parallel route via surface streets.

Using an Akrollo meter, which accurately checks on gasoline consumption up to 5/100s of a gallon, the club's test car consumed 0.80 gallon of gasoline in travelling 16.59 miles via the expressway as compared to 1.30 gallon of gasoline used in driving 17.90 miles of surfaced streets. At this rate, the club study revealed, a 20-mile trip would consume 1.0 gallon of gasoline via expressway and 1.5 gallon of gasoline via travel on existing surface streets.

As a result of the study, the club estimated that motorists who use the Arroyo Seco Parkway save better than 10 cents per 20 miles of travel.

State of California

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DIVISION OF CONTRACTS AND RIGHTS OF WAY (LEGAL)

C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney

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1947

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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Public Works Department Saves State More Than Million Dollars On Purchases Of War Surplus

By REX FULTON, Associate Highway Engineer

SINCE January, 1946, the California Division of Highways, acting through the Department of Finance, has purchased $817,500 in material from the War Assets Administration, resulting in a net saving to the State of over $500,000.

During the same period, the Division of Architecture, acting through and in conjunction with the Department of Finance, purchased and erected $266,938 worth of scarce and nonexistent building materials and equipment from the War Assets Administration resulting in a net saving to the State of $522,190.

In general, the items purchased were nonexistent on the open market and have ranged from pen points to fork lift trucks, covering 350 commodities.

One of our major purchases was steel fence posts which were furnished in 5-foot, 2 feet 8 inch and 2-foot lengths. These posts are obviously too short for right of way fences and arrangements have been made to butt weld a 2-foot and 5-foot post together making a 7-foot post. Ten holes are then punched along the post for fastening the wire by means of cotter pins or staples. The holes are so spaced as to permit fastening any of the standard combinations of woven and barbed wires. The posts are then wire brushed and given a shop coat of zinc-chromate paint, the paint also having been purchased from war surpluses.

Corner, end and gate posts are similar construction, except that two line posts are longitudinally welded to make a double post of tubular section. Braces will consist of 5-foot and 7-foot line posts attached with bolts.

BIG PURCHASE OF STEEL POSTS

The posts are of a winged-channel or hat section and weigh approximately two pounds per foot, whereas our highway specifications require a weight of only 1.4 pounds per foot. It is proposed



New steel guide posts in place

to furnish the steel fence posts as state-furnished material on contracts after July 1, 1947, at which time they will be available in quantity.

Out of a total of 1,429,441 steel posts purchased in various lengths, similar items are being fabricated such as sign posts in lengths of from 5 feet to 12 feet, and guide posts in lengths of 5 feet 4 inches.

Because of the current scarcity of suitable timber, it is proposed to fabricate about 275,000 guide posts, which consist of two 2-foot 8-inch posts butt welded for a total length of 5 feet 4 inches, on which is mounted a steel plate 8 inches x 24 inches in size and painted white. The completed steel guide post can be furnished for the same price as wood and will have the additional advantage of being driven into place, whereas the wood post must be dug-in and then field painted. A net saving of about $0.65 each, complete in place, is anticipated by using the steel post.

At the present time, neither the War Assets Administration nor anyone else has been able to furnish suitable sheet metal in quantity for making the plate. Operations are therefore restricted to making about 7,000 guide posts from materials on hand. However, the fabrication of this initial order will offer an opportunity to eliminate any bugs in their development, such as: Should the plate be welded to the post or will additional handling costs favor field assembly? Should the edges of the plate be rolled to minimize lacerations in highway accidents? It is hoped that these questions will be clarified in the field before full production gets under way.

THREE MILLION TENT PEGS

Another major item in quantity if not in monetary value, is 3,000,000 tent pegs purchased from war surplus. These pegs are hardwood, turned from 1 inch x 9 stock. They are nicely pointed and headed and will make excellent survey stakes for reference points as small hubs, commonly known as "ginnies." Three million such stakes are at least a five years' supply.

The department has also analyzed various usages of other materials, such as mail bags for stake bags; gauze for wiping cloths; pilot house stools for drafting stools; barracks and quonset huts for offices; powder magazines for ware houses; and rubber life rafts for survey boats.

NYLON ROPE USES

Nylon rope used in parachute construction has been successfully used by painters on the Bay Bridge. Nylon is about 2½ times as strong as manila and is light and flexible.

Another item of reconversion was the adaptation of tin spice boxes by the laboratory. The large tin boxes con-

tain a set of cans which were used as sample cans, and the outside box and lid were made into laboratory utensils.

As a correlation to war surplus activities, the Division of Highways purchased 4,500 tons of steel "H" piling from the Bethlehem Steel Company. It was found that as each bridge contract was let, a delay of from six to nine months was entailed in scheduling the rolling of necessary piles. Rather than accept this delay on each project, it was deemed advisable to accept the delay but once, and maintain an active inventory in this item for use by contractors.

Because of the necessity of temporarily storing the piles, requiring additional handling charges, it was not so much the intention to save money on this transaction as to render a service in speeding up construction operations.

Included in the total saving effected by surplus purchases is $76,967.04 saved by the Headquarters Shop of the Division of Highways in Sacramento in the acquisition of $111,244.52 worth of equipment.

Fourteen 12-yard Le Tourneau scrapers were bought at a saving of $7,500; 13 Dodge Command trucks were acquired at a saving of $22,000; and the purchase of eight 25 kilowatt generator sets effected a saving or $5,700.

These are only three of several hundred war surplus items obtained by the Headquarters Shop.

The savings made by the Division of Architecture were on the following projects:

90,240 square feet of steel Army barrack buildings used as classrooms for veterans' educational program at six state colleges;

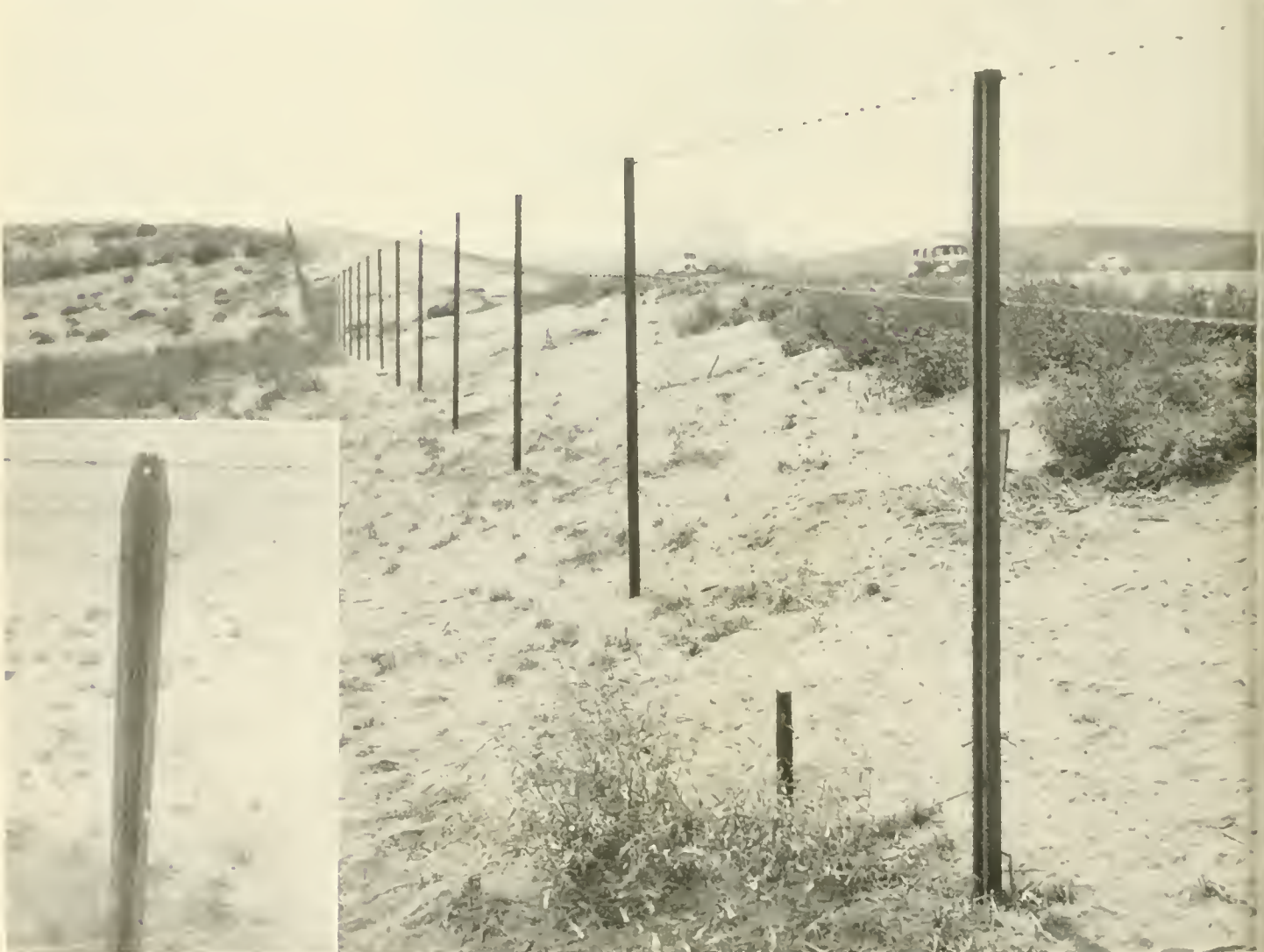
25,600 square feet of Army barrack buildings used as housing facili-

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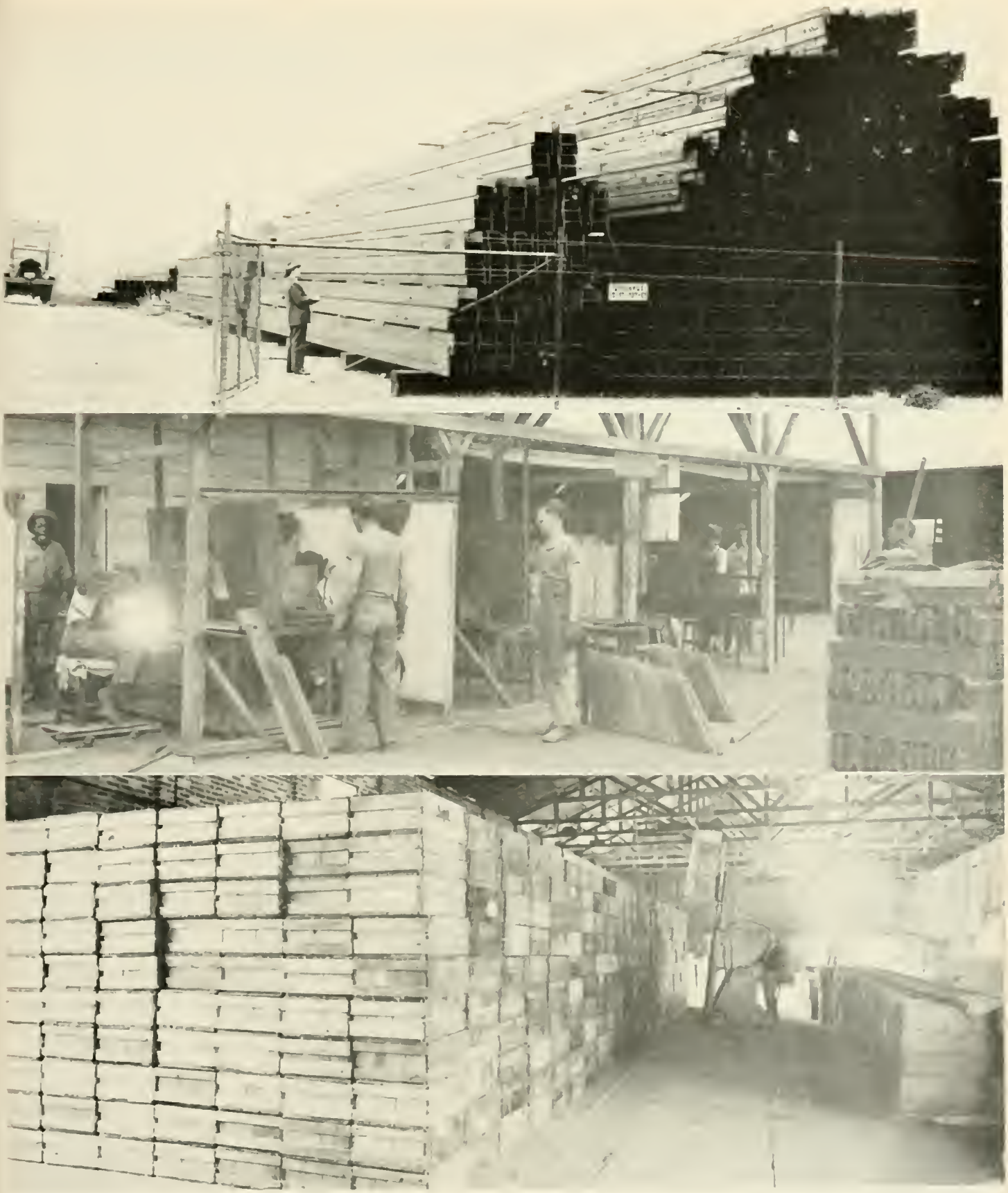
Use of Survey Stakes Being Standardized by Division of Highways

NORMAL use of survey stakes by the Division of Highways is about 1,350,000 stakes annually consisting of 23 varieties purchased in small amounts by the 11 highway districts at a total cost of $40,000 a year.

By standardization on six different sizes of stakes and buying a year's supply at a time, the division recently has let contracts whereby the required number of stakes can be distributed to the districts for a total cost of $25,000, resulting in a net saving to the State of $15,000 annually.



Steel fence posts fabricated from war surplus. Inset shows how wire is mounted with cotter keys



Upper—"H" piling at Wilmar purchased for current bridge construction program. Center—Furnaces where steel fence posts are welded
Lower—Boxes containing approximately three million tent pegs stored at Puente warehouse for future use as survey stakes

Modernization of Coast Highway

EARL E. SORENSON, District Construction Engineer

ACCEPTANCE by the Director of Public Works on May 19, 1947, of the completed contract for the "Traffic Signal Installation" at the main entrance to Camp Pendleton completed a series of five contracts which have transformed Route 2, U. S. 101, "El Camino Real," into a modern four-lane highway from Oceanside to San Clemente, a distance of approximately 20 miles. The signals were installed by the Tri-Cities Electrical Co. of Oceanside at a cost of approximately $6,000.

The heavy traffic resulting from military needs and congested population over this portion of the highway, resulted in numerous accidents and property losses, which made the improvement imperative. Unusual accidents which occurred due to conditions resulting from defense activities and probably inadequate highway facilities are illustrated in the accompanying photo of a collision between a large motor line truck and an airplane which failed to clear on the San Onofre overhead. The improvement has nearly eliminated the possibility of this type of accident.

NEW BRIDGE

The preceding units of this series of contracts covered the construction of a new bridge paralleling an existing concrete structure across San Mateo Creek. The existing bridge, which is in excellent condition, will handle north bound and the new one south bound traffic. The bridge was constructed by Oberg Brothers of Inglewood at a cost of approximately $160,000, with W. H. Johnson as Resident Engineer for the State.

Where the traffic warrants, and due to both economy and the possibilities for handling existing traffic with a minimum of inconvenience, the installation of a new structure entirely separate from the existing one represents a policy which is rapidly gaining in favor.

VARIOUS CONTRACTS

The section of highway from the vicinity of Las Flores underpass to Orange County line was constructed by N. M. Ball Sons of Los Angeles under the supervision of H. F. Caton as Resident Engineer for the State. The total cost was approximately $695,000.

Basich Brothers Construction Company of Alhambra constructed the portion of highway from Oceanside to Aliso Creek at an approximate cost of $635,000. R. C. Payne was the State's representative in charge.

The grade separation across the Santa Fe main line at Oceanside was supervised for the State by W. V. Cryderman as Resident Engineer, with Fred D. Kyle Company of Los Angeles as the Contractor. The cost approximated $100,000.

Considerable investigation and preliminary planning entered into the design of this unit of the work. At this location the old three-lane highway was separated from the railway by an underpass which was in good shape and, based on modern standards, adequate for one-way traffic, both from a volume and safety standpoint. However, the curved approaches leading to it from both directions restricted the sight distance and made it a danger point for two-way traffic.

(Continued on page 8)



Showing six-foot separation by means of double stripe north of Flores

Traffic Striping Developments

By MARTIN O'BRIEN, Maintenance Department

TRAFFIC stripes and other pavement markings are recognized as very necessary aids in the operation of traffic on the highways. The development of such items as the standards to be followed and specifications for materials, as well as of the equipment used in placing the stripes and markings, have been given much attention during the last 20 years, and improvements are still in process.

The standards of traffic marking as now defined by the Joint Committee on Uniform Traffic Control Devices are quite generally observed by the various states. In order to comply with these standards, California, early in 1946, adopted a combination solid and dashed four-inch white line for zones where traffic proceeding in one direction is permitted to pass—while that in the opposing lane is restricted.

This dashed line consists of nine-foot lengths of painted stripe spaced fifteen feet apart. No change has been made in the two solid parallel white lines which denote zones where passing over the center line into the opposing lane is prohibited. Our experience with the dashed line has been very satisfactory since we find it not only provides good visibility under varying conditions but effects a 60 percent reduction in material costs.

TRAFFIC LACQUER FORMULAS

Paint manufacturers as well as laboratories of the several highway departments have developed satisfactory formulas to meet the exacting requirements of traffic lacquer for striping and pavement marking purposes. These qualities include such items as quick drying and long life under the wear of traffic as well as good adherence to concrete and a variety of bituminous surface types without serious discoloration. The material must also serve to hold glass beads embedded in the surface.

Unfortunately, it is not possible at the present time to secure the materials required to make up good quality traffic lacquer. Before the war it was not unusual for a stripe to give satisfactory service for a period of 18 months or even more. Under present conditions it is frequently necessary to repaint the stripes on heavily traveled sections of highways five times in an 18-month period. It is hoped that this material situation will improve shortly, but in the meantime it is impossible to maintain the stripes to a desirable standard.

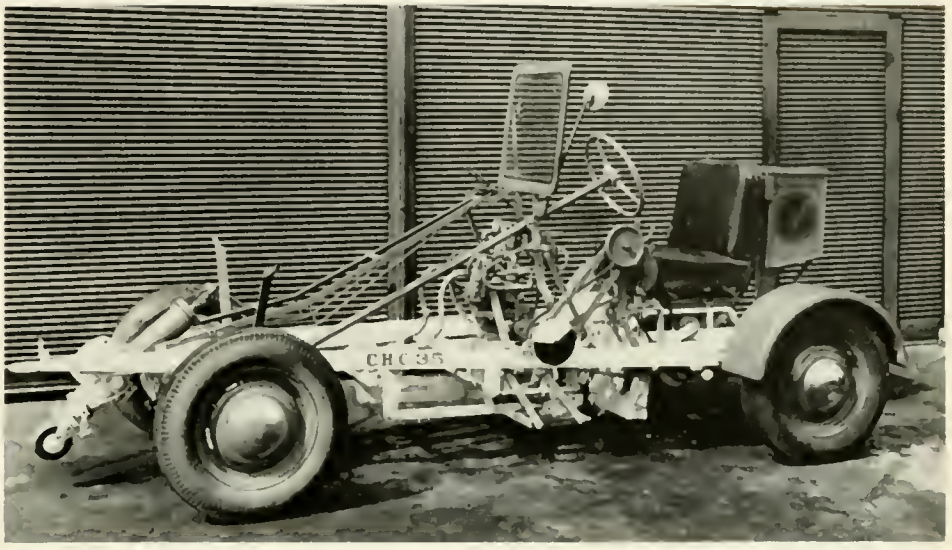


Photo No. 1

EQUIPMENT IMPORTANT

The equipment used in placing these stripes is very important. However, due to the many changes in stripe design, commercial products have not been available and many of the states have proceeded with the design of their own equipment. At first, the work in California was done with a hand-propelled machine. Later, this unit was towed by a truck until it was found to perform more satisfactorily when pushed in front of the truck. The first push-type machine was built during 1935 and since then some eleven such units have been constructed. Refinements have been added from time to time to keep pace with the changes in striping design. These changes were largely developed as a result of information supplied Headquarters Shop personnel by the paint machine operators.

When only solid stripes were being placed the equipment required was comparatively simple. The striping machine consisted mainly of a frame on wheels with a seat for the operator and support for the spray guns and the paint and air hose lines. The paint supply tanks and the compressor which furnished air to operate the spray guns were carried in the bed of the pusher truck.

WARTIME STRIPING

When the use of a broken stripe was adopted as a wartime conservation measure it became necessary to develop an arrangement to turn the paint on and off at definite intervals. It was necessary also to synchronize the operation of the bead dispenser which consisted of a small trailer unit placed immediately behind the paint sprays. The development of a satisfactory design would not have been so difficult for a single application of a stripe in restriping if it were not imperative to match the original marking.

In the machine constructed during wartime the cycle length was governed by a disc valve operated by a bicycle wheel which was in contact with a drum on the rear axle of the striping machine. In machines of this type, the cycle length of the broken line is affected by any change in the radius of the driving wheel. Such change may be caused by variations in temperatures, the weight of the operator riding the machine, air pressure in the driving wheel, or a number of other causes. Frequent adjustments were accordingly necessary to pick up or retard the operation of the paint guns and bead dispenser to account for these variants.

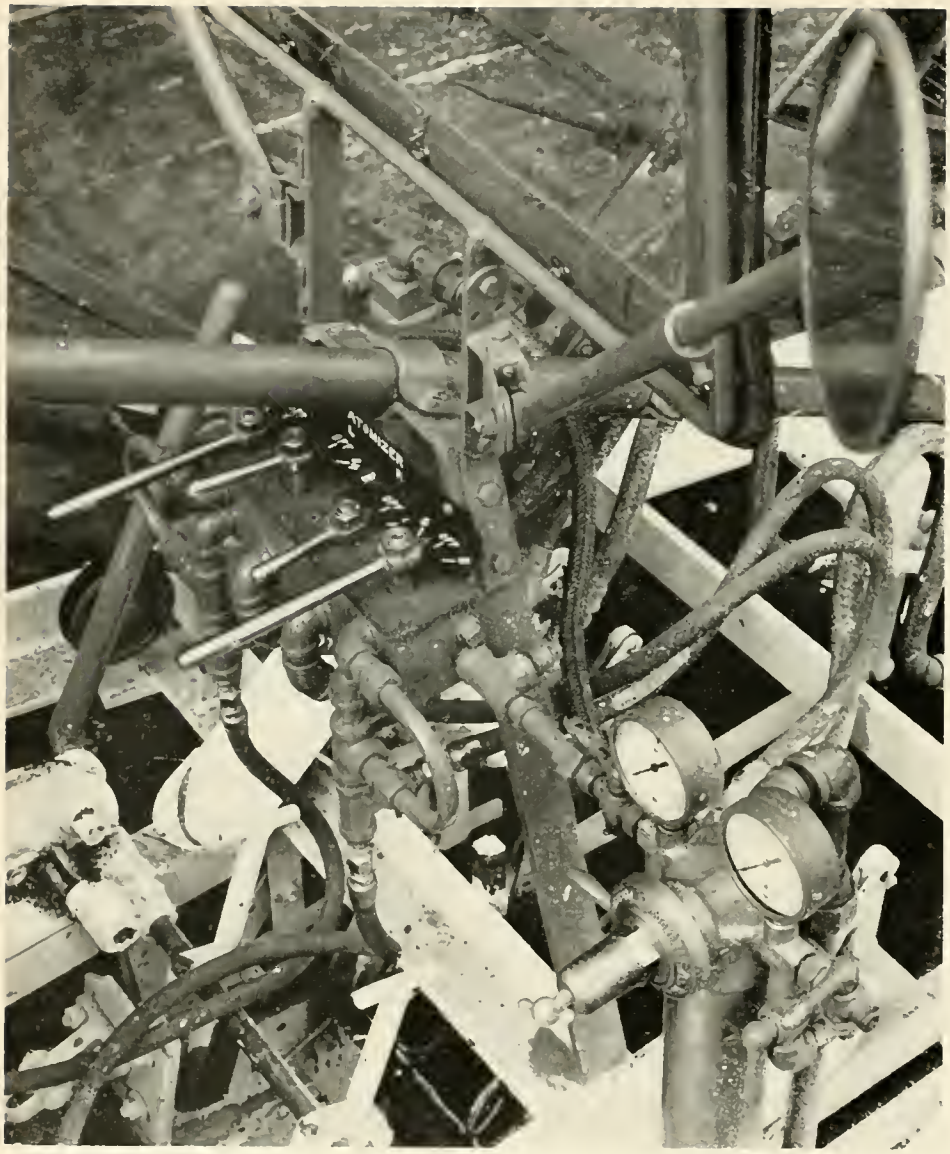


Photo No. 2

NEW MACHINES NECESSARY

It was necessary to develop a more positive control for retracing the broken stripe and since other desirable improvements had been suggested, it was decided to construct 12 new machines. One machine has now been completed and given a careful field trial and work is in progress on the others.

In redesigning the striping machine simplicity of operation was a first objective. The routine operation of the machine in placing the present standard stripes requires that the operator be able to make the following transitions in sequence of work without stopping the machine:

1. To place a single broken stripe.
2. To place a double white stripe consisting of a broken stripe on the left and a solid stripe on the right.
3. To place double solid white stripes.
4. To place double white stripes consisting of a broken stripe on the right and a solid stripe on the left.
5. To place a continuous black stripe between the double stripes when required.

BEAD DISPENSER

A second objective was to design a bead dispenser which would make a uniform application of beads at a predetermined rate and would also follow out the above sequence of operations with accuracy.

A third objective was to allow painting an offset stripe adjacent to traffic bars, and other locations where the machine could not be operated directly on the line of the stripe.

A fourth objective was to improve the machine so the alignment of the stripe would not be seriously affected by rough pavement, etc.

A fifth objective was to provide for the comfort and convenience of the operator and to save time in cleaning out the hoses and spray guns at the end of painting operations.

IMPROVEMENTS MADE

The new striping machine as shown in **Photograph No. 1** retains the same general appearance as the present machines. However, a knee action front axle is now used to compensate for rough or uneven pavement. A higher more comfortable seat is provided and the operator's platform has foot rests. A windshield and rear view mirror are also provided.

The spray equipment is arranged for good visibility and all controls are within convenient reach of the operator. Three paint nozzles are provided, two for white lacquer and one for black lacquer, the black line being placed between the two others for use on concrete pavement when required. The entire assembly is readily removed for cleaning.

The controls for operating the new striping machine are entirely different from those used on the older machines and are much more simple and accurate when set. The air and lacquer are both carried in pipe lines from the supply in the body of the pusher-supply truck to manifolds installed close to the paint spray guns. Operations are controlled by the four small levers shown in **Photograph No. 2**. The two long levers operate the mechanism for painting white lines. They control the supply of air and lacquer to the spray guns as well as air required to operate the bead dispensers. These levers control a system of three-way valves.

LEVER OPERATION

When placed in the position marked "S" a solid or continuous line will be placed. When turned to the position marked "B" a broken line will result. The two shorter levers operate the spray gun atomizers and are only turned off when the machine is not in operation. The mechanism controlling

the placing of the broken line consists of two poppet valves. These values are operated from an adjustable cam, which in turn, is driven by one of the rear wheels. The cam is on the same shaft as the close-up of the white and black disc shown in **Photograph No. 3.** This disc represents one cycle of the line and space. The disc acts as an indicator to the operator who may make an adjustment by means of the small wheel in order to start the line directly over an old line.

In order to lengthen or shorten the cycle of the stripe and space an adjustable double sheave is arranged in the drive from the driving wheel axle to a cam shaft which has been substituted for the bicycle wheel drive used on the old machine. By rotating the double sheave assembly forward or backward the sheaves are increased or decreased in diameter but still retain the same belt length necessary in the drive. This is done by turning a horizontal adjusting screw at the top of the assembly in either direction as desired. The double sheave assembly is mounted on a hinged plate for raising in order to overcome belt wear and to act as a tightener. All revolving shafts are mounted on self-aligning ball bearings to eliminate excessive wear. This type of assembly obviates the necessity of making frequent adjustments and repairs.

BEAD DISPENSING MACHINES

There are two bead dispensing machines, one directly behind each white paint spray gun. Each dispenser consists of a small bead storage compartment located over a cone which extends into a circular opening in the bottom of the compartment. The cone is welded onto a shaft which is connected to an air cylinder. When air is turned on to operate the paint spray the same supply of air operates the air cylinder and opens the compartment to allow beads to flow over the cone.

When the air supply is shut off a spring returns the cone to its former position. The opening is closed and the flow of beads is shut off. Small fins are placed on the surface of the cone to insure a uniform distribution of beads onto the line. The two dispensers are connected by flexible metal hoses to a box located behind the operator's seat



Photo No. 3

which contains the main bead supply. A narrow window in the back of this hopper enables the truck driver to observe the bead supply to insure replenishing the supply when necessary.

LIFTING DEVICE

The front end of the unit weighs 650 pounds, and it is necessary to provide a lifting device so that it may be raised and attached to the rear of the paint truck when traveling. The cylinder arrangement shown on the front of the spray rig is an air hoist or air lift for this purpose. The air lift has a rubber-tired castor wheel attached to the lower end of the cylinder to facilitate side shifting in order to hook the towing rig onto the truck draw bar after the front end of the machine is raised to the necessary height. The air lift will raise the front end of the machine to a height of 36 inches off the ground.

Most of the older trucks now equipped and used with the paint striping machines are to be replaced and an effort will be made to secure cab-over-engine types which provide much better visibility for the truck operator when pushing the paint machine ahead of the truck. On account of the inaccuracy of speedometers at the low speeds at which paint striping is done, all trucks are being equipped with engine tachometers so that a uniform speed of the truck can be determined when applying a paint stripe. Mechanically driven paint agitators are being installed in the paint supply tanks as well as better facilities for cleaning the tanks, piping, and hose.

The idea of the cone type gravity-feed bead dispenser was developed and details worked out by James J. Keleher, Assistant Mechanical Foreman, and the various improved features of the spray machine were worked out and the entire machine constructed at Headquarters Shop under the directions of Frank E. Burnside, Shop Superintendent, and R. H. Stalnaker, Equipment Engineer.

Tramp: "I've asked for money, I've begged for money, and I've cried for money, mum."

Lady: "Did you ever think of working for it, my man?"

Tramp: "No mum. You see, I'm going through the alphabet and haven't come to W yet."

Traffic cop—"Say, you! Didn't you see me wave at you?"

Sweet young thing—"Yes, but you're wasting your time. I'm engaged to be married."

Modernization of Coast Highway

(Continued from page 4)

Consideration was given to increasing or doubling its width by the construction of a duplicate pass alongside, permitting the complete physical separation of traffic and avoiding disturbance of the existing structure. The extremely heavy military traffic to be carried on the railroad during the period of construction prevented this solution, which would have been both feasible and economical in normal times. As no method could be devised which would not result in some delay to traffic on the rails, and as no practical railway by-pass was possible, the plan was abandoned.

The matter of constructing an entirely new overhead for both north and southbound traffic was then investigated, and was discarded due to the extremely heavy construction expense and to the dictates of good engineering, which, from an economy standpoint, required consideration of the high salvage value of the existing underpass.

Thorough study of all possibilities, both from a traffic standpoint and cost features, eliminated all methods but the construction of a new overhead for northbound traffic only and the utilization of the existing structure for southbound traffic only. This plan eliminated all interference with railway traffic and permitted total salvage of the underpass.

Insofar as we know, this design is unique in that highway traffic is carried on two separate planes with the rail traffic in between. The arrangement is illustrated by one of the accompanying photographs.

Innovations and techniques which were developed on these jobs were described in an article appearing in the May-June, 1946, issue of this magazine. Experiments in the placing of cement stabilized base described in this article were continued, and resulted in the development of a new method insofar as placing cement stabilized base from a central mixing plant is concerned. On the Basich Brothers portion of the highway contract, a Barber-Greene mixing plant was used to proportion and mix the aggregate, water, and cement at a central location. The material was then hauled to the street and spread through a Barber-Greene spreader.

(Continued on page 30)

Public Works Department Saves State More Than One Million Dollars on War Surplus Purchases

(Continued from page 2)

ties for attendants who are mostly returned veterans, on four state hospital sites;

11,360 square feet of Army barrack buildings to be used as classrooms and treatment for cerebral palsied children on two sites—one in the south and one in the north section of the State;

4,480 square feet of Army barrack buildings use das housing facilities for inmates at the Veterans Hospital and Women Relief Corps Home;

111,520 square feet of Army barrack buildings used as classrooms for the education and rehabilitation of inmates at five state prisons;

8,160 square feet of Army barrack buildings used as classrooms for the teaching of trades and the education of delinquent juveniles at two state correction schools;

The surplus barrack buildings as listed above originally cost the Army approximately $2.30 per square foot. The State was able to secure these buildings at one-half the original cost less an additional 40 percent discount, or $0.69 per square foot if used for educational purposes or for veterans' use.

Approximately $115,000 of Army surplus laundry and kitchen equipment at a cost of $54,000 to the State is installed in the various hospitals, schools, and prisons throughout the State.

About $18,000 of surplus electrical wire, transformers, pipe, mechanical equipment, consisting of boilers, pipe machines, and miscellaneous items, was purchased at a total cost of $7,500 to the State and installed at five state hospitals, schools, prisons, and various other state institutions.

The Division purchased $68,000 of surplus building materials at a cost to the State of $32,000, consisting of 125M FBM of lumber, 60,000,000 square feet of 4-inch insulating material, 200 kegs of nails, barbed wire, roofing material, 50,000,000 square feet of 18 gauge corrugated aluminum sheets, and many other materials too numerous to list.

Report on Progress and Records in Pavement Construction During 1946

By EARL WITHYCOMBE, Assistant Construction Engineer

DURING the year 1946, a total of 395.6 miles of pavement and surfacing was constructed of which 387.1 miles was on the State Highway System. Of the 8.5 miles off the system, 7 miles was county secondary construction and 1.5 miles was federal access.

Of the total mileage built, there were 71.7 miles of portland cement concrete or asphalt concrete, which is about six times the mileage of high type pavement built in 1945. The beginning of construction of the postwar highway program accounts for this decided increase in pavement mileage.

Nearly 308 miles of the 387.1 miles constructed on the State Highway System, or 80 percent, consisted of resurfacing of existing pavements or a combination of widening and resurfacing. This is a good indication of the present condition of the State Highway System. For every mile of new construction for which funds are available, it was necessary to provide major repairs for another 3.8 miles, in order to keep the highways in operating condition. Considering the number of miles of major repairing carried on during the war years when new construction was prohibited, the ratio is even greater than the yearly comparison indicates.

Portland Cement Concrete

All of the concrete pavements built in 1946 were constructed without expansion joints. Weakened plane joints were installed at 15-foot intervals. All were built in single lane widths, and the longitudinal joint was provided with load transfer by means of a tongue and groove design which is maintained in contact by means of tie-bolts threaded into hexagonal metal couplers imbedded in the slab. All pavement was 5-sack concrete.

Weakened plane joints were constructed with a depth of groove of only one and one-fourth inches. It was hoped that this shallow depth of groove would provide a greater amount of coarse aggregate interlocks in the subsequent crack through the remainder of the slab. The relatively large percentage of mid-panel cracking in some projects has lead to a change in depth of groove to two inches, or one-fourth the thickness of the slab. Nearly all of the mid-panel cracking originated at a tie-bolt.

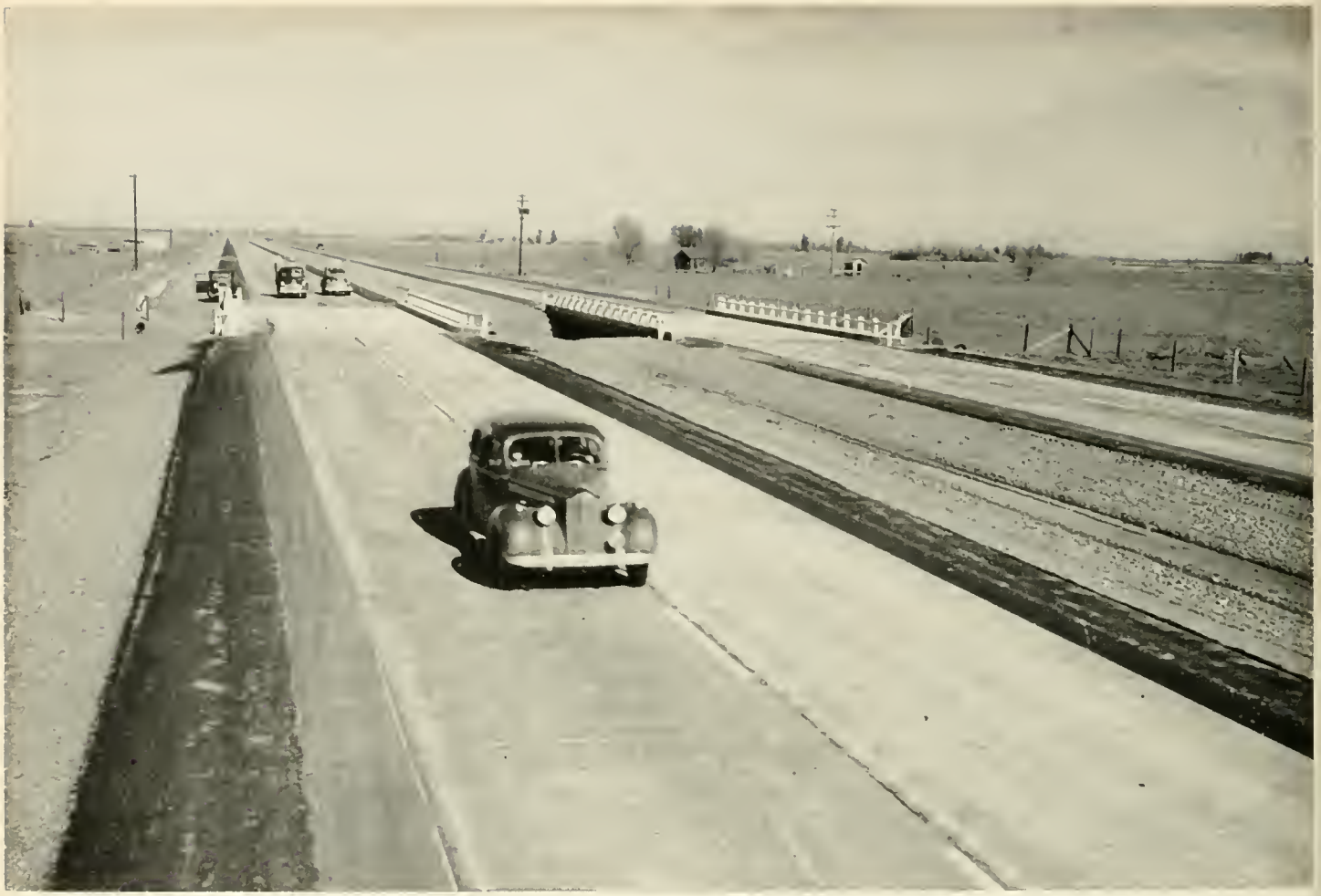
The omission of provision for expansion has resulted in but one pavement blowup to date. This was occasioned within a few days after the slab was poured and before the concrete had obtained sufficient strength to resist shear diagonally through the longitudinal axis. A sudden rise in temperature during summer construction caused the failure. The defective panel was removed and replaced prior to the completion of paving. It is the belief of the department that the relief from the many defects brought about by the presence of expansion joints will result in a much longer life of pavement, and the benefits derived from their omission will far outweigh the cost and annoyance of repairing an occasional blowup. The fact that there has been but one failure in some 53,000 panels to date would seem to indicate that too much reliance has been placed on the former belief that expansion joints were essential to prevent frequent failures in the pavement.

Nearly all the paving projects in 1946 started without the aid of trained finishers, as they were not available. As a result, considerable experimenting was resorted to by the districts to sim-

(Continued on page 11)

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1946

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per day	Average strength 28 days, lbs. per sq. inch	Roughness index, inches per mile
Concord Ave.-0.4 Mi. W. of Ohmer Sta.	Guy F. Atkinson Co.	H. H. Deardorf	E. Carlstad	285.0	3195	7.6
Oakland Distribution Structures-7th St.	Lee J. Immel	F. W. Montell	L. G. Marshall	203.9	3731	13.1
Calwa Overpass-Fresno	M. S. Hanrahan	C. F. Oliphant	F. B. England	562.1	4000	5.9
Brundage Lane-24th St., Bakersfield	Griffith Co.	J. W. Cole	R. Ostrander	508.9	2420	13.4
Route 77, Pomona	Matich Bros.	C. L. Gildersleeve	H. D. Johnson	457.0	2826	12.5
Vineyard Ave.-Etiwanda Ave.	Matich Bros.	J. M. Cowgill	J. Smith, C. Dibble	633.3	3466	7.0
Mulberry St.-Colton	Griffith Co.	B. Nelson	J. B. Smith	763.0	3442	5.9
Redlands, State St.-E. City Limits	Matich Bros.	J. M. Hollister	K. Stone	597.5	3322	12.0
Ulatis Creek-Midway	Fredrickson Bros.	G. R. Hubbard	W. Douglas	619.4	3487	6.0
Midway-2 Mi. N. of Dixon	Fredrickson Bros.	G. R. Hubbard, W. L. Hurd	W. Douglas, W. Lewis	581.6	3675	5.9
Grant Line Road-Mossdale	M. J. B. Constr. Co.	E. L. Craun	F. J. Leithold	335.4	3212	5.5
1 Mi. N. of Flores Cr.-San Clemente	N. M. Ball Sons	H. F. Caton	W. Cattell	594.4	3595	8.3
San Luis Rey River-0.2 Mi. N. Aliso Cr.	Basich Bros. Const. Co. & Basich Bros.	R. C. Payne	R. Goodell	407.7	2613	7.7
			Averages	568.5	3400	7.4



Two recently completed 23-foot lanes of portland cement concrete pavement near Dixon, Solano County

ASPHALT CONCRETE PAVING RECORDS FOR 1946

Location	Contractor	Resident Engineer	Street Assistant	Average tons laid per day	Average stability of surface mix %	Roughness index inches per mile
Waldo-Ignacio	Brown-Ely Co.	G. Heberling	C. Schemel	465.0	42	20.9
Oakland, Distribution Structs., 7th St.	Lee J. Immel	F. W. Montell	G. Levier	473.6	41	16.0
2 Mi. S. of Salinas-Salinas	Granite Constr. Co.	G. Hamlin	A. L. Lamb	444.7	45	14.0
Calwa Overpass-Fresno	M. S. Hanrahan	C. F. Oliphant	R. S. Percival	329.7	43	13.9
Brundage Lane-24th St.	Griffith Co.	J. W. Cole	R. H. Ostrander	560.5	44	23.8
Orange Grove Ave.-San Fernando Blvd.	Chas. J. Dorfman	H. E. Belford	H. E. Belford	538.0	47	30.0
Burbank Blvd.-Orange Grove Ave.	Jesse S. Smith	F. A. Read	F. L. Everitt	719.7	42	26.1
Rosemead Blvd., Huntington Dr.-Colorado St.	Griffith Co.	C. P. Montgomery	H. E. Belford	849.0	41	12.9
Vallejo, Virginia St.-Santa Clara St.	C. M. Syar	G. R. Hubbard	G. R. Hubbard	462.9	43	21.5
1 Mi. N. Las Flores Cr.-San Clemente	N. M. Ball Sons	H. F. Caton	C. Hagberg	699.0	34	19.2
San Luis Rey River-0.2 Mi. N. Aliso Cr.	Basich Bros. Const. Co. & Basich Bros.	R. C. Payne	R. Goodell	410.1	44	28.5
			Averages	530.6	42	20.6

Report on Progress and Records in Pavement Construction During 1946

(Continued from page 9)

plify finishing and improve the quality of the work performed by the inexperienced personnel.

One district eliminated the edging of weakened plane joints. By timely manipulation of the steel forming strips and careful withdrawal, no edging of the joints was necessary. To prevent breakage of the joint edges under the cut float, the joints were poured with the asphalt sealing compound prior to cutting. This practice resulted in the smoothest riding pavement of the year and none of the projects in this District exceeded 6.0 inches per mile of roughness, which is a remarkably good record.

On one entire project and on portions of another, the weakened plane joints were cut in the pavement by means of power driven diamond-studded saws. The joints formed in this manner are very pleasing in appearance and the process seems to have considerable merit. The equipment used is one that has been developed commercially within this State.

The **highest average daily production** was obtained on the largest paving job of the year, Contract 8XC5-F, between Mulberry Street and Colton; Griffith Company, Contractors, and B. Nelson, resident engineer, with J. B. Smith, street assistant, 62,183 cubic yards of concrete were poured at the average rate of 763 cubic yards per day, with one double-drum mixer.

The **best average strength** for concrete pavement was obtained on Contract 6TC3-F, between Calwa Overpass and Fresno; M. S. Hanrahan, contractor, C. F. Oliphant, resident engineer, with F. B. England, street assistant, in which the average of 28-day cylinders was 4,000 pounds per square inch.

The **record for riding qualities** was obtained on Contract 10TC10-F, between Grant Line Road and Mossdale; M. J. B. Construction Company, Contractors, E. L. Craun, resident engineer, and F. J. Leithold, street assistant, in which the average roughness index was 5.5 inches per mile. The average for the State in 1946 was 7.4 inches per mile as compared to 14.2 inches in 1945.



Two 23-foot lanes of plant-mixed surfacing near Mira Loma, Riverside County

Asphalt Concrete

Side forms were used on slightly more than half of the asphalt concrete tonnage laid in 1946. Spreading and finishing was performed by the type of machine that rides on the side forms. The resulting riding qualities were somewhat disappointing in that they were no better than the average for the year. The knack of operating such equipment apparently has been lost since the use of the type of machine that establishes its own grade has become more common.

The standards for subgrade under asphalt concrete have been materially raised. No subgrade in the 1946 program had a bearing ratio of less than 80 percent. They consisted of crusher-run base, cement-treated base, and portland cement concrete.

The **highest average daily output** of asphalt concrete was reached on Contract 7XC15-F, Huntington Drive to Colorado Street, on Rosemead Boulevard. Griffith Company were the contractors, C. P. Montgomery, resident engineer, and H. E. Belford, street assistant. An average of 849 tons were laid per day. This project also holds the yearly record for riding qualities with an average of 12.9 inches per mile. The average roughness index for the year was 20.6 inches per mile, as compared to 24.7 inches in 1945.

The **highest average stability** results of surface mixtures for the year were obtained on Contract 7AVC1 in Burbank, from Orange Grove Avenue to San Fernando Boulevard, Chas. J. Dorfman, Contractor, H. E. Belford, resident engineer, with an average of 47 percent.

Bituminous Treated Surfaces

Bituminous treated surfacing in 1946 was largely constructed by plant-mix methods, 86 percent being mixed through a plant and 14 percent mixed on the road.

The trend in plant-mixed surfacing is toward the use of heavier oils and asphalts. In many projects, paving asphalts were used to good advantage. This was made possible principally by the use of the self-propelled spreading and finishing machines that operate without the use of side forms. The use of cutback asphalts has been practically abandoned due to the differential in price and to the susceptibility of the mixture to trouble from moisture.

The 1946 record for **smoothness of riding surface on plant-mixed surfacing** was obtained on Contract 8VC6-F, between Mira Loma and 2.5 miles west of Riverside; George Herz & Co., Contractor, E. A. Bannister, resident engineer, with an average of 7.4 inches per mile. The average for the State was 17.0 inches per mile, as compared to 19.5 inches per mile in 1945.

The 1946 record for **smoothness on road-mixed surfacing** was obtained on Contract 11VC8, 6 miles east of Desert Center to Hopkins Well; Arthur A. Johnson, Contractor, M. C. Barron, resident engineer, with an average of 12.5 inches per mile. The average for the State was 22.1 inches per mile as compared to 31.2 inches per mile in 1945.

Although we have not reached the standard of excellence in pavement construction that existed prior to the war, the marked improvement in all types of pavement over that of the previous year is very gratifying. The construction employees are to be congratulated on their accomplishments under adverse circumstances, and the Contractors have earned the gratitude of us all for their cooperation which made these accomplishments possible.

BITUMINOUS TREATED SURFACES—RECORD FOR 1946

PLANT MIX

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
Loleta-Patricks Point	Mercer, Fraser Co.	H. M. Hansen	10.6
Loleta-Fields Landing	Mercer, Fraser Co.	H. M. Hansen	14.0
Patricks Point-Big Lagoon	Mercer, Fraser Co.	E. L. Blomquist	13.5
Willits-2.6 Mi. N.	C. M. Syar	R. A. Burns	16.3
Burke Hill-1 Mi. N.	C. M. Syar	F. H. Johnson	23.7
1.2 Mi. N. of Rodman Narrows Rd.-Rte. 15	Louis Biasotti & Son	C. A. Shervington	15.6
Fall River Mills-8.3 Mi. E. of Bieber (por.)	M. J. Ruddy & Son	W. H. Bartlett	21.9
Yreka-Camp Lowe	Clements & Co.	D. Elder	18.7
Weed-Yreka (por.)	Clements & Co., Milo A. Browne	D. Elder	11.6
4.5 Mi. E. of Ingot-Montgomery Cr.	W. C. Railing	P. F. Duffy	34.6
Seamans Gulch, 1 Mi. W. of Ingot	A. A. Tieslau & Son	Ray Huck	25.3
1.5 Mi. W. of Bird Flat-Doyle	Utah Construction Co.	H. B. Milner	14.5
Viewland-Secret Valley	E. B. Bishop	J. Aramayo	16.2
Shasta River-Gazelle	Clements & Co.	D. Elder	14.8
3 Mi. N. of Arbuckle-4 Mi. S. of Williams	Harms Bros.	E. Hay	16.2
Cache Creek-Dunnigan	Fredrickson Bros.	F. E. Wilson	16.5
Oroville Wye-Nelson, Durham RRXing-Chico, Big Chico Creek-6th St., Chico	Lester L. Rice	T. Jain	33.5
Williams, 293 Ft. S. of F St.-D St.	Harms Bros.	E. Hay	18.8
Mile 6.5-Mile 8.0, Rte. 99	A. Teichert & Son	M. E. Ryan	16.5
4.7 Mi. W. of Tahoe City-1.7 Mi. S. of Nev. Co. Line, Truckee Wye-Church St., Truckee	Clements & Co.	L. E. Christman	17.6
Sacramento-0.5 Mi. E., 0.4-9.6 Mi. N. of Solano Co. Line	Harms Bros.	C. H. Weeks	16.2
A St. & Redwood Rd., San Lorenzo Creek Bridge-Poctor Rd.	Hayward Bldg. Material Co.	E. W. Brocett	33.6
Maitland Dr.-Earhart Rd.	Gallagher & Burk	F. W. Montell	12.0
Concord Ave.-0.4 Mi. W. of Olmer Sta.	Guy F. Atkinson Co.	H. H. Deardorf	22.5
Dublin-Mission San Jose, Alvarado-San Leandro	A. S. Jones	C. D. Hamma	14.4
At Hollister Wye	Jesse S. Smith	J. C. Adams	15.9
Prunedale Junction-Santa Clara Co. Line	Granite Constr. Co.	A. L. Lamb	8.8
Santa Maria River-1.5 Mi. S. of Nipomo	Fairey-Hammond Inc.	H. J. Holman	20.7
Fairview Ave.-Tecolote Cr.	Dimmitt & Taylor	J. C. Adams	11.1
Hollister Wye-Fairview Ave.	Dimmitt & Taylor	J. C. Adams	12.4
Santa Rita-0.8 Mi. N. of Crazy Horse Summit	A. Teichert & Co.	V. E. Pearson	7.7
Famosa-Cecil Ave., Delano	Griffith Co.	J. W. Cole	16.8
3.6 Mi. S.-0.4 Mi. S. of Kingsburg	Valley Paving & Const. Co.	P. A. Boulton	14.0
8.7 Mi.-2.0 Mi. W. of Wasco	Griffith Co.	J. W. Cole	21.1
1.4 Mi. N. of El Toro Rd.-S. City Limits of Tustin	John J. Swigart	B. N. Frykland	9.7
Los Patos Ave., Sunset Beach-Second St., Seal Beach	Griffith Co.	C. L. Gildersleeve	15.0
Verona St.-W. City Limit Santa Aana	John J. Swigart	B. N. Frykland	9.6
6th St.-0.4 Mi. N. of Imperial Hwy.	Cox Bros. Constr. Co.	Roy Cooley	9.2
Sproul St.-Anaheim-Telegraph Rd.	Griffith Co.	C. L. Gildersleeve	12.0
Mulberry St.-Colton (por.)	Griffith Co.	B. Nelson	14.7
Victorville-Oro Grande Underpass	George Herz & Co.	L. M. Barnett	10.2
Midway-E. City Limits, Banning	Herz Paving Co.	J. M. Hollister	24.5
Cameron-Mojave	Gunner Corp.	R. F. Johnson	10.6
In Venicia, various streets	Parish Bros.	G. R. Hubbard	18.9
Byron Rd.-Banta Rd.	M. J. Ruddy & Son	W. H. Ammon	23.9
Atwater-2 Mi. N.	Gunner Corp.	M. W. Ellis	9.5
San Joaquin River-Madera Co. Line	Frank B. Marks & Sons	George Barry	20.0

BITUMINOUS TREATED SURFACES—RECORD FOR 1946—PLANT MIX—Continued

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
Leucadia-San Mateo Creek (por.)	N. M. Ball Sons	W. T. Rhodes	9.3
San Ysidro-Chula Vista, Rte. 2-Imperial Beach, Grossmont-El Cajon	R. E. Hazard Contracting Co.	J. F. Jorgenson	11.7
Las Posas Rd., Rte. 2-Rte. 153	MacDonald & Kruse	R. M. Cooley	11.8
About 0.5 Mi. N. of Palmdale	A. A. Edmondson	F. L. Everitt	23.6
Mira Loma-2.5 Mi. W. of Riverside	George Herz & Co.	E. A. Bannister	7.4
Calexico-El Centro, and in El Centro	Tanner Const. Co.	L. H. Williams	18.0
		Average	17.0

ROAD MIX

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
5th Standard Parallel S.-1.5 Mi. N.	W. C. Railing	R. Windele	36.6
Alpine-Lake Arrowhead-Burnt Mill	R. R. Hensler	O. B. Brinkerhoff	24.7
Rte. 23-Sheep Corral	George E. France	L. Wulff	34.0
Antioch Bridge-Emmaton	Sheldon Oil Co.	W. F. Fleharty	39.8
6 Mi. E. of Desert Center-Hopkins Well	Arthur A. Johnson	M. C. Barron	12.5
1.3 Mi. N. of Imperial Co. Line-0.5 Mi. S. of San Bernardino Co. Line	Arthur A. Johnson	L. W. McCleary	17.4
		Average	22.1

ARMOR COAT

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
N. W. Pacific R.R. Underpass-1.1 Mi. S. of Willits	A. R. McEwen	R. A. Miller	71.4



These 30-foot lanes were resurfaced with asphalt concrete south of San Clemente in Orange and San Diego Counties



El Camino Real looking north at Broadway, San Mateo, showing unit of progressive signal system

Thirty-Five Miles Per Hour Speed Limit Solves Many Problems on El Camino Real

By JERRY O'SHEA, Assistant District Traffic Engineer

THE EL CAMINO Real (U. S. 101) is one of the two principal arterials leading from San Jose and the Peninsula into the City of San Francisco. This route had its origin as a trail used by the Padres in traveling between the California Missions during the Eighteenth Century. The section with which we are concerned was the connecting link between Mission Santa Clara, near San Jose, and Mission Dolores in San Francisco. The old trail has steadily improved until today it is one of our most important highways serving the highly developed Peninsula area south of San Francisco.

With the removal of the restrictions on speed which were in effect during the war, the district was immediately faced with the problems of speed on the Peninsula as a whole. Newspapers and civic groups began a campaign for enforcement and the installation of numerous signals and traffic control devices; however, most of these were not obtainable since they required a large amount of critical material.

CONGESTED AREA

The section of the Peninsula presenting the greatest problem was that extending from Menlo Park to Burlingame, which, progressing northward, passes through the Cities of Menlo Park, Atherton, Redwood City, San Carlos, Belmont, San Mateo and Burlingame, all bordering one on the other.

This area is composed largely of residential districts and the majority of the people work in San Francisco. Both the Bayshore Highway and El Camino Real run through this area paralleling each other, the Bayshore being one to two miles easterly of El Camino Real. At this time El Camino Real was a "hodge-podge" of 55 m.p.h. zones, speed traps in the form of unreasonable "slow-down" areas, and a nonuniform series of open and restricted zones. With so many transitions from 55 m.p.h. zones to 25 m.p.h. zones, the traveling public and the enforcing officers were under a great burden. Because of the large amount of roadside development, the entire character of El Camino Real was changed from one of a highway to that of a city street. This can be clearly seen from the accompanying photographs.

SPEED ZONE SURVEY

In November of 1945 a speed zone survey of El Camino Real was started. The topography through each city was mapped in order to qualify existing business and residential zones. Speed checks were taken at several locations in each city. The accident records were investigated and the enforcing officers interviewed. As the information was gathered for each city, the result of the survey was presented to the chief of police and the speed restriction possibilities as outlined in the Vehicle Code were explained.

After consultations with the chiefs of police of the cities involved and the California Highway Patrol, it was the aim of this district to establish El Camino Real as the safest route of travel for recreational drivers, Peninsula shoppers, and others whose principal interest is to safely reach their destination, leaving the Bayshore Highway for those drivers, particularly the daily commuters, whose interest is to get to their destination as rapidly as possible. It was agreed by all concerned that the solution to the problem was the establishment of a uniform series of 35 m.p.h. speed zones extending through the Peninsula cities from the southerly limits of Menlo Park to the northerly limits of Burlingame. This would provide the traveling public with a route which could be used with a feeling of security at a speed materially below that on the Bayshore Highway, yet fast enough to safely reach their destination without passing through unreasonable "slow-down" areas.

AUTHORITIES COOPERATE

At the time the zones were discussed with the chiefs of police, a few were dubious as to the wisdom of removing 25 m.p.h. zones and the substitution of 35 m.p.h. zones; however, they admitted that the enforcing officers were issuing citations for very few cars in the 25 to 35 m.p.h. speed bracket. Their attitude was that while they did not enforce a 25 m.p.h. speed limit, it was an added protection for themselves and was necessary in shopping areas and where school children crossed the highway.

It was pointed out to them that while a road is zoned for 35 m.p.h., it is not a license to drive at that speed through the 24 hours of the day. Section 511(a) 1 of the Vehicle Code sets forth a prima facie speed limit of 15 miles per hour when passing school grounds while children are playing, or going to, or leaving the grounds. During the evening hours when shoppers and commuters increase the vehicular and pedestrian traffic volume, the speed of vehicles is governed by Section 510 of the Vehicle Code. This section sets forth that no person shall drive a vehicle upon a highway at a speed greater than is reasonable or prudent, having due regard for the traffic on, and the surface width of, the highway, and in no event at a speed which endangers the safety of persons or property.

When it was brought out to these chiefs of police that the traveling public in general should not be penalized by a slow restricted speed zone in order to provide an enforcement medium required for a short period of time and for a small percentage of drivers because these factors are taken care of by the Vehicle Code in the two sections which were quoted, there was then complete agreement as to the establishment of the 35 m.p.h. speed.

SPEEDING IS REDUCED

After the zones had been in effect for several months, the chiefs of police of the cities involved, the enforcing officers, and the California Highway Patrol were again contacted and their opinion was requested as to the merits

(Continued on page 17)



El Camino Real looking north at Broadway, Redwood City.







Upper—El Camino Real looking north from Five Points, Redwood City, showing roadside development in progress. Center—El Camino Real looking south at San Mateo Avenue, San Bruno. Lower—El Camino Real looking north at Jenevein Avenue, San Bruno, showing typical roadside development.

Order of the Director of Public Works Adopting Regulations for the Enforcement Of the California Outdoor Advertising Act

WHEREAS, By Section 5215 of the Business and Professions Code, the Director of the Department of Public Works is authorized to make orders and regulations for the enforcement of the Outdoor Advertising Act, Division 3, Chapter 2, of the Business and Professions Code, as amended, and to authorize the Division of Highways of the Department of Public Works to enforce the provisions of said act and of said regulations; and

WHEREAS, Division 3, Chapter 2, Article 6 of said code sets out certain regulations for the enforcement of said Outdoor Advertising Act, particularly regulations with respect to prohibited signs, structures and locations; and

WHEREAS, It appears desirable and in the public interest that the interpretation of the Department of Public Works of said regulations, and particularly of the provisions of Section 5286 of said Code with respect to such prohibited signs, structures and locations, be set forth for the guidance of persons and corporations subject to the provisions of said act; and

WHEREAS, It has been found and determined, and the Director of the Department of Public Works does hereby find and determine, that the use in illuminated advertising displays, or for any advertising purpose, of red or yellow color illumination, or any color or combination of colors, which gives the effect of red or yellow, or the use of red, yellow or green flashing, blinking, or intermittent lights, or the placing of displays containing reflector units or reflecting elements, at the locations or in the shapes or designs hereinafter specified, simulate and imitate directional and information signs, and warning and danger signs and signals, and are likely to be mistaken for such permitted signs and signals and are likely to be construed as giving warning to traffic;

NOW, THEREFORE, Pursuant to the authority vested in the Director of the Department of Public Works by law, and in particular by said Section 5215 of the Business and Professions Code, IT IS HEREBY ORDERED that the following regulations be, and the same are hereby, adopted by the Director of Public Works as regulations for the enforcement of the Outdoor Advertising Act:

1. No advertising display shall be placed

(a) Within the right of way of any highway;

(b) If visible from any highway and simulating or imitating any directional, warning, danger or information sign or device permitted under the provisions of the Outdoor Advertising Act, Division 3, Chapter 2, of the Business and Professions Code, as amended, or if likely to be mistaken for any such permitted sign or device, or, if intended or likely to be construed as giving warning to traffic, such as by the use of the words "stop" or "slow down";

(c) If visible from any highway and displaying any flashing, blinking or intermittent light likely to be mistaken for a warning, traffic, danger signal or device;

(d) If the illumination thereon is of such brilliance and so positioned as to blind or dazzle the vision of travelers on highways adjacent thereto; or

(e) If in violation of any other regulation or provision of said act or of these regulations.

2. ILLUMINATED DISPLAYS (Other than displays containing reflecting elements). No red or yellow illumination, or any color or combination of colors which gives the effect of red or yellow, shall be used for, on, or in any illuminated advertising display, and displays using such colors for illumination are hereby prohibited, except in the following locations:

(a) Upon the building occupied by the business advertised or in which the product or article advertised is sold;

(b) On the same parcel of land and at the immediate location of the business advertised;

(c) In an unincorporated village, town, or business district, as defined by Section 89 of the Vehicle Code.

3. DISPLAYS CONTAINING REFLECTOR UNITS OR REFLECTING ELEMENTS. Displays containing reflector units or reflecting elements (including reflectorized sheeting material or surfaces coated with glass beads) of the shape or in the locations hereinafter specified are prohibited

(a) If in the design or shape of an arrow;

(b) If placed on curves, except on the outer side thereof;

(c) If placed on either side of the highway within 800 feet of any official warning sign indicating a curve or within 300 feet of any other official warning sign, unless facing in the opposite direction from such official signs.

4. FLASHING LIGHTS. If visible from any highway, any blinking, intermittent, or flashing light containing red, yellow or green, or any color or combination of colors which gives the effect of red, yellow or green, is prohibited.

5. These regulations are hereby promulgated as the interpretations of the Department of Public Works of the provisions of Division 3, Chapter 2, Article 6, of said Business and Professions Code, particularly Section 5286 thereof, for the purpose of further defining prohibited signs, structures and locations.

6. The Division of Highways of the Department of Public Works and the State Highway Engineer and his authorized representatives are hereby authorized and directed to enforce the provisions of said Outdoor Advertising Act and of these regulations, and are further authorized and directed to revoke any license or permit heretofore issued for any violation of the provisions of said act or of these regulations.

7. Those certain regulations heretofore adopted and referred to as Division of Highways Circular Letters Nos. 44 and 55, are hereby superseded, and said circular letters hereby revoked. This order shall be effective as of the date hereof.

Dated at Sacramento, California, this third day of June, 1947.

C. H. PURCELL
Director of the Department of Public Works

(Original signed by C. H. Purcell)

Thirty-Five Miles per Hour Speed Limit Solves Problem

(Continued from page 15)

of the 35 m.p.h. speed limit. In all but one case, the reactions were extremely favorable. There was complete concurrence in that the uniform speed zones established on this route promoted an excellent enforcement program since it eliminated 55 m.p.h. gaps between zones.

It was observed that the character of the traffic had changed to a great extent and those drivers who previously were making full use of the open zones, slowing somewhat in the restricted zones, had been forced over to the Bayshore Highway where they could maintain a 55 m.p.h. speed and least endanger themselves and others. Recreational drivers, the so-called "Sunday drivers," realized that the new zone afforded them a great deal of protection and thus many of the slower-moving vehicles were removed from the Bayshore leaving it for those drivers, the commuters in particular, whose destination had to be reached in haste.

Many of the chiefs of police were so enthused with the workings of the 35 m.p.h. zone that they have requested the assistance of the District Traffic Engineer in setting up 35 m.p.h. zones on arterial city streets under their jurisdiction.

SPEED CHECKS TAKEN

A series of speed checks were taken along the new zone the early part of this year in order to make a comparison with the checks taken before its establishment. In all instances the new checks showed no increase and in some locations a marked decrease in vehicular speeds.

Since El Camino Real is undergoing a change from a highway to a city street, further provision must now be made for the orderly movement of vehicles. With this in mind, the district traffic department is in the proc-

(Continued on page 29)



THE MAJOR relocation of the present state highway, State Sign Route 1, and the Construction of a freeway from Rob R will involve the construction of eight major bridge structures and two large arch culverts. Of these 10 structures, two South Aptos and North Aptos Underpasses. The remaining six major structures are the Aptos Creek and Spreckels Dr crossing, Bay Avenue Undercrossing, Soquel Creek and Wharf Road combined bridge, Soquel Road Overcrossing near Wood The two large arch culverts are located on Valencia Creek near Aptos. The new freeway will provide a four-lane roadway wit by a dividing strip. Alignment of the new freeway will provide a more nearly direct route from Rob Roy Junction to Santa than the existing highway. Roadway curves are of long radii.

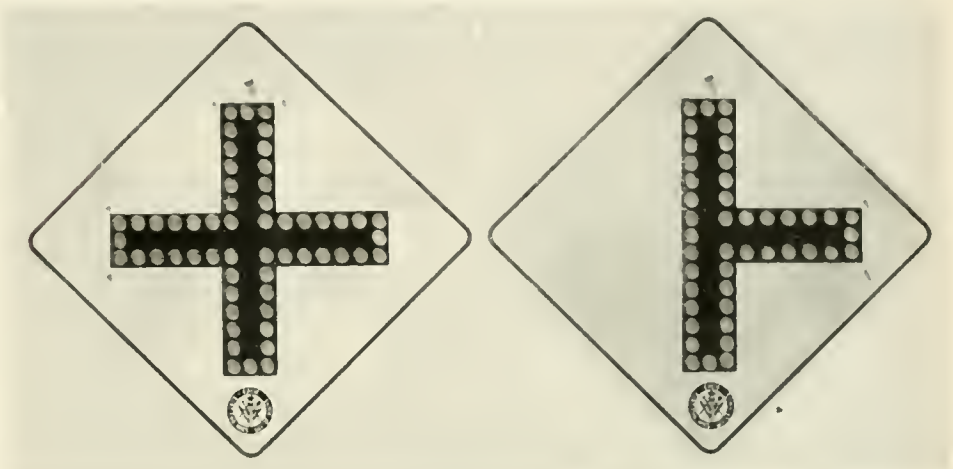


tion to Morrisey Avenue in Santa Cruz
ailroad grade separations known as the
oined bridge, the Capitola Avenue Over-
on, and La Fonda Avenue Overcrossing.
nes of traffic in each direction separated
nd will have much less total curvature

New Directional Signs Set Up by State

DIRECTOR of Public Works C. H. Purcell has announced that the Division of Highways will conform to the recent changes in highway warning signs recommended by the National Joint Committee on Uniform Traffic Control Devices. This committee is composed of representatives of the American Association of State Highway Officials, Institute of Traffic Engineers and National Conference on Street and Highway Safety.

Certain of the square warning signs have been changed to diamond shape, and the messages shortened or replaced by symbols.



Motorists will soon see two of the new signs pictured above, which will be used in lieu of the old familiar CROSS ROAD and SIDE ROAD signs.

The erection of these new signs will be gradual as they will only be erected as replacements are required.

Henceforth, the erection and maintenance of state highway directional signs will be handled by the Division of Highways. For many years this work was done by the California State Automobile Association and the Automobile Club of Southern California. The emblem on the new signs will be that of the Division of Highways instead of those of the Automobile Clubs.

In connection with the new system of sign posting on state highways, Director of Public Works C. H. Purcell wrote to the California State Automobile Association as follows:

"Gentlemen:

"As you know, the agreement between the State, your organization and the Automobile Club of Southern California relative to sign posting on State Highways expired January 1, 1947. The matter of renewing this agreement has been given long and careful consideration. In view of the splendid cooperation which the department has had from both clubs throughout the years, the department naturally feels reluctant to allow the long-standing arrangement to be discontinued. However, it is the conclusion of the Sate Highway Engineer, in which I concur, that the volume of the sign-posting work, including maintenance, has become so great and of such urgency as to require the State to organize its own forces to handle the work directly. Accordingly, the decision has been reached not to ask the two clubs to renew the contract.

"I am advised by our legal department that since the contract has expired, there will be no continuing or further obligations on the part of either club to maintain any sign heretofore placed.

"I wish to take this occasion to express to you my appreciation and that of the whole State Highway Department for the great contribution you have made to the State and to the public highway programs in California over so many years. The State Highway Department alone has benefited by many hundreds of thousands of dollars in the value of labor and other services which you have contributed without cost. An even greater benefit has been achieved by reason of the uniformity in signing of our streets and highways which has resulted from the activities of the clubs in furnishing this service to the State, the counties, and the cities.

"It is with this thought in mind that I wish to ask that the monthly committee meetings with your representatives on signing matters be continued so that we may have the benefit of your wide experience in this field. Inasmuch as you will undoubtedly continue to be the road-signing agency for the respective counties and the cities, it is highly desirable that these meetings be continued, so that our mutual purpose of continued uniformity may be achieved."

Marysville-Yuba City Bridge Will Be Completed Next September 1

By C. C. WINTER, Associate Bridge Engineer

A MODERN highway is being constructed on new alignment between Marysville and Yuba City to facilitate traffic between and through these two cities when the new bridge which will replace the old narrow and inadequate span across the Feather River is completed about September 1st.

The traffic count in the summer of 1940 over the existing bridge was 18,380 vehicles on a Monday count. A traffic jam occurs daily during the morning and evening rush hours and is accentuated during the fruit harvest season. The old bridge is 19 feet between curbs and is posted to restrict speed for loads over five tons. The new highway will by-pass the main business streets of the two cities.

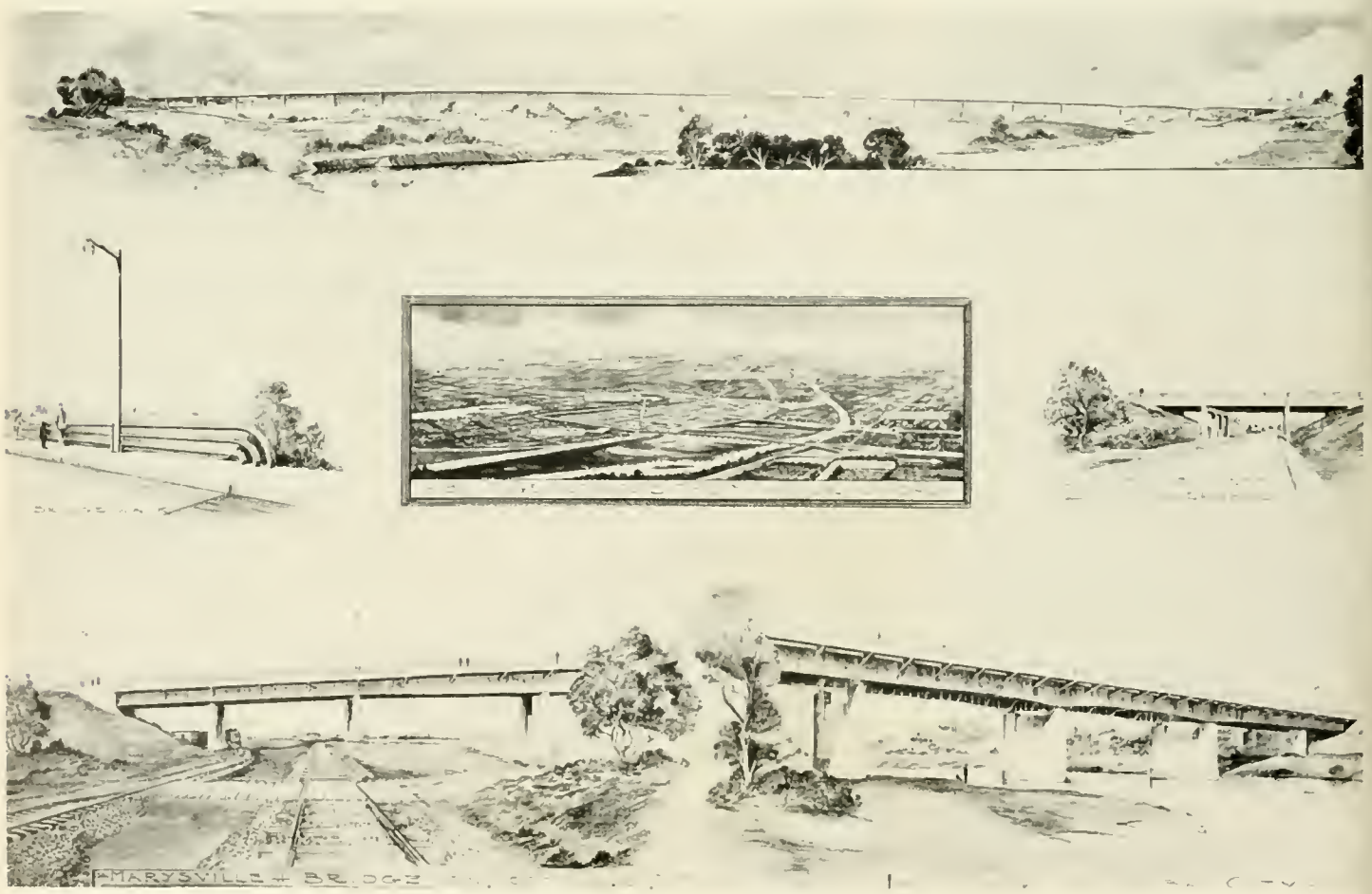
The new Feather River Bridge is a steel plate girder bridge over the Western Pacific Railroad tracks and the Feather River. The bridge consists of 24 spans. Most of these are 115 feet long, but longer spans up to 161 feet are used across the main channel of the river. Every second span contains a 72-foot suspended girder. This bridge is 2,674 feet long. The deck will provide four lanes divided by a four-foot strip and flanked by sidewalks, steel railing and street lighting. The overall width is 66 feet 4 inches.

The pier and highway construction was described in the September-October, 1946, issue of this magazine.

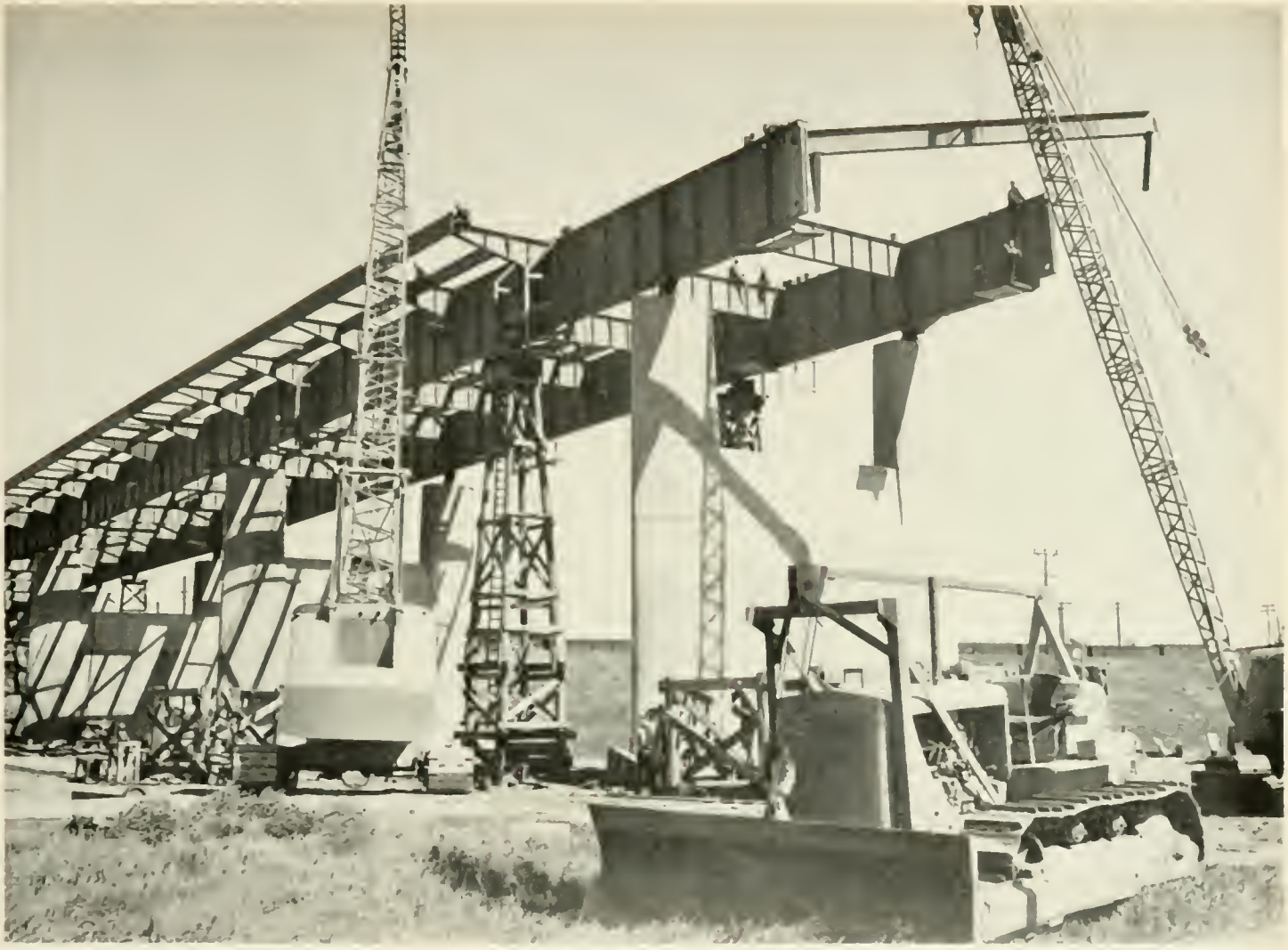
The bridge piers were started March 9, 1946, and all piers were ready for structural steel on October 18, 1946. A temporary road and bridge was constructed over the river during the low water and it was possible to work piers from the ground. Very good progress was made in spite of difficulties encountered in getting lumber and construction materials.

Structural steel erection could have been started early in July, 1946, and if materials had been available this bridge probably would have been completed in 1946. Due to strikes and consequent delays some of the necessary steel shapes were not delivered to the fabricators until early in February 1947.

The first structural steel girders were received March 24, 1947, and the last are expected in June.



This sketch by Van der Goes of the Bridge Department of the Division of Highways excellently portrays various features of the Marysville-Yuba City bridge now under construction



This construction view of the Marysville-Yuba City Bridge shows steel superstructure being erected

In general the girders weigh 17 tons over the piers and 22 tons in the suspended spans and are 10 feet deep. The girders over Piers 22 and 23 at the river near the Yuba City end are 13 feet deep and 93 feet long and weigh about 56 tons. A temporary road with culvert pipes is being rebuilt to serve during the erection of the structural steel.

The steel is received on railroad cars at a siding in Marysville where it is unloaded and stored until needed. While there, it is prepared for erec-

(Continued on page 25)



This is the new four-lane divided approach to the Marysville-Yuba City bridge

Modoc County Leads in Federal Aid Secondary Road Program

By F. W. HASELWOOD, District Engineer

AT LONG last, after 10 years of effort, Modoc County's dream of an improved highway along the west side of Surprise Valley is being realized with the completion of the first major federal secondary highway project to be awarded.

Modoc County occupies a rectangular area of 4,094 square miles in the northeastern corner of California. It has a population of 8,713. The topography is mountainous with lava-strewn plateaus and peaks up to 10,000 which separate the fertile valleys. Alturas, the county seat, is located at the junction of the north and south forks of the Pit River.

Modoc County had its part in the early history of the State. Here crossed the trails of the pioneers, Applegate, Lassen, Bidwell, Fremont, Thompson, and others. Over the Applegate Trail from the Humboldt Valley, across Surprise Valley and the Warner Range, and along Goose Lake into Oregon came the early pioneers in wagon trains. Here were the Indian wars, the story of which reveals little to justify pride in the part taken by the white men.

VARIED POLITICAL HISTORY

Modoc County has had a varied political history. It was once a part of the self-styled State of Deseret, which never obtained recognition by the Federal Government, then a part of Utah, later a part of Roop County, Nevada, and, in California, a part of Siskiyou before being split off as a separate county.

Surprise Valley is aptly named. Truly, the view of Surprise Valley from vantage points of the Hays Canon Range on the east or the Warner Range on the west is a surprise.

Early in the 1860's, the United States Cavalry was established at Fort Bidwell. The first store in Cedarville was established by Townsend, in 1865. After he was killed by the Indians, the store was sold by his widow to Wm. Cressler and John H. Bonner. The first road over the Warner Range, through Cedar Pass, was built by Bonner. The grade from Cedar Pass down to Cedarville is an official historical monument known as the Bonner Grade. Judge E. C. Bonner, a well-known resident of Alturas, is the son of the pioneer John H. Bonner.

Geographicallly most of the county is in the Cascades, but east of Alturas and extending through the county from north to south, are the Warner Mountains. This is the most westerly of the basin ranges and its eastern front compares in ruggedness and picturesqueness with the western front of the Wasatches in Utah, which is the eastern boundary of the Great Basin.

SURPRISE VALLEY CREATED

The Warner Range is an orogenic block elevated from a lava-strewn plateau and, at the time of its elevation, parallel depressions occurred on either side. On the west the depression is occupied by Goose Lake and the two forks of the Pit. On the east the depression, once a lake 70 miles long, 6 to 7 miles wide, and 550 feet deep, has been filled with silt and is now Surprise Valley. The remnants of the lake are three shallow playas, upper, middle, and lower alkali lakes. In very wet seasons these lakes may have as much as two feet of water. Most seasons they are dry.

Surprise Valley is connected with the rest of the county and California by a state highway which crosses the Warner Range at Cedar Pass, at elevation 6,350, and descends Cedar Creek to Cedarville.

East of Surprise Valley and parallel to it in the State of Nevada is the Hays Canon Range, another of the innumerable north and south basin ranges. Between the Hays Canon Range and the three playas in the center of the valley, the bench and valley land is dry, covered with sagebrush, and is used for grazing only. From the foot of the Warner Range to the three playas, the land is watered by the fairly abundant runoff from the Warner Range, which is usually held at the high altitude as snow until late spring. This strip of land, some three to eight miles wide and 50 miles long, is fertile and productive.

PRODUCTS OF VALLEY

The products of Surprise Valley are grain, hay, alfalfa, potatoes, alfalfa seed, and livestock. The towns are Cedarville, at the foot of the Warner Range, where Cedar Creek and the state highway emerge, Eagleville, 15 miles south, Lake City, 10 miles north, and Fort Bidwell, 25 miles north.

Surprise Valley in Modoc County contains 60,234 acres of grazing land and 44,338 acres of irrigated farming land. Of the latter, in 1946, 7,911 acres were devoted to raising grain, 6,657 to alfalfa hay, and 13,595 to native or other hay crops. The balance is devoted to miscellaneous crops. There are 358 farm units in the area.

In 1946 the major shipments from the valley were: Cattle, live, 17,177; cattle, slaughtered, 1,684; hogs, slaughtered, 1,800; sheep, live, 20,000; sheep, slaughtered, 800; wool, 150,000 pounds; alfalfa seed, 100,000 pounds; baled hay, 3,000 tons.

Other products, not all of which are shipped out, are 302,149 pounds of butter, and 12,000 sacks of potatoes. The potatoes were produced on 60 acres. In 1947, the expected acreage of potatoes is 250.

BENEFITS OF NEW HIGHWAY

In addition to the products of Surprise Valley in Modoc County, the northeastern corner of Lassen County and northern Washoe County in Nevada, which formerly shipped via Gerlach, Nevada, now ship via Modoc's new highway and Cedarville. These areas comprise 1,400 acres of hay land and winter range for 30,000 cattle and 10,000 sheep. Also, the outlet for products of Warner Valley in Lake County, Oregon, is via Modoc's new highway and Cedarville.

Future extensions of the highway north and south will contribute greatly to the economic benefit of this highway to the areas directly served and to the whole State.



View of Modoc County's new Federal Aid Secondary Highway taken about six miles north of Cedarville, looking north. Upper Alkali Lake is on right and the Warner Range is on the left

The effect of the construction of this highway on Cedarville is very pronounced. New business establishments have been built, old ones renovated and expanded, and a great increase in all lines of business has been noted. As an illustration, 1946 commercial deposits in the Cedarville bank increased 23 percent over those of 1945.

The principal traffic movement in the valley is along the west side roads connecting with the state highway at Cedarville. All of the products of the valley are moved over these roads and the highway to outside markets and all outside necessities are brought in over them. The shipment of cattle by truck is particularly heavy in the fall and the west side county roads have frequently been in such a condition that the transportation trucks would not go beyond Cedarville and much loss of weight resulted when stock were driven to this point on the state highway.

MODOC TAKES INITIATIVE

Modoc County has long been ambitious to have an improved highway from Lassen County on the south, through Surprise Valley and on to the Oregon line, some 18 miles north of Fort Bidwell, a total length of about 65 miles. County officials have at times nourished hopes that this west side road might some day become a state highway.

Modoc County has not been in the habit of sitting down and depending on wishful thinking to make her dreams come true. Back in 1938, without assurance of outside aid, Modoc County set out to grade a road between Cedarville and Eagleville to state highway standards. In 1939 the Federal Government offered the first direct aid to counties for construction of feeder roads leading from rural areas to a state highway. This aid had to be matched by the local agency and Modoc was prepared with the matching funds. As a result, two units were graded and surfaced in 1940. One was 4.6 miles, extending from Cedarville southerly toward Eagleville. The other was 10.9 miles long, extending from four miles north of Lake City to half a mile south of Fort Bidwell. These units were graded, graveled and surfaced with road-mixed gravel under contracts awarded and supervised by the Division of Highways.

STATE GIVES AID

The discontinuance of federal assistance to counties did not deter Modoc County. There were still 25 miles of unsatisfactory road between Eagleville and Fort Bidwell and the supervisors of the two districts did something about it. Partly by their own efforts and partly with the direct aid or supervision of the engineers of the Division of Highways these 25 miles were located to improved standards. With limited funds allocated for the purpose, over 15 miles of this was graded and drained and a gravel base was constructed by the end of 1945.

The final impetus came in 1945 when the Federal Highway Act of 1944 became effective. This act authorized the establishment of a system of federal aid secondary highways and provided for financial aid for their improvement over a period of three years beginning July 1, 1945. By the County Highway Aid Act of 1945, state funds were made available for matching these federal aid secondary funds. The State also provided financial aid to the counties in the form of an appropriation of $90,000,000 commonly referred to as "Chapter 20 Funds." These funds were allocated to the counties for improvement of roads, for water supply, sanitation, and other special purposes. Of the amount allocated for road use, only $75,000 did not require matching by local funds. The balance

required matching by local funds on a 50-50 basis.

ACTIVITY INCREASES

With this turn of the financial tide, activity in Modoc County for additional improvement of the Surprise Valley Road was revived. In the process of adopting a system of federal aid secondary highways in each county, this Surprise Valley Road from the Lassen County line to Fort Bidwell, 50.3 miles, was included.

As in the case of many counties in the State, Modoc County lacked the engineering organization to plan and supervise a project of such magnitude. Consequently, the Division of Highways was given the task of preparing the plans and supervising the construction of a 29.5-mile project which included the resurfacing of 4.6 miles.

Considerable attention was given by District II to the problems of these federal aid secondary projects in the several counties of the district. It seemed apparent that the success or failure of the principle of federal aid for this class of roads depended on the progress and success of the construction program. If the execution of this program lagged or failed for whatever cause its continuance seemed doubtful.

MODOC PROJECT

The urgent need for road improvement in the rural counties where local finances were so inadequate, and where engineering organizations were lacking, required the attention and assistance of the district if there was to be a demonstration of ability of these counties to take full advantage of the program, in those counties, including Modoc, where assistance from the district was welcome, major projects utilizing available funds for the three-year pediod were contracted in 1946. It has been amply demonstrated by Modoc and other rural counties that, with proper encouragement and some assistance, the problems of the trial period of this federal aid adventure into the rural communities is being met with great local benefit.

This Modoc project required completion of the grading and drainage construction of a gravel base and a plant-mixed gravel surface 20 feet wide and 2 inches thick. The streets of Eagleville and Cedarville were paved full width and, through Cedarville, curbs and gutters were constructed.



This photograph was taken south of Cedarville. The 10,000-foot Eagle Peak of the Warner Range is in the background

All along the valley at the base of the Warner Range, gravel is abundant in the deltas at the outlets of the steep canyons and in the old lake shore deposits. Many of the road cuts are through gravel deposits. Approximately 90 percent of road grade, whether in cut or fill, consists of gravel. One of these deposits, about two miles north of Cedarville, was used as a source of mineral aggregate for plant-mixed surface.

CONTRACT TOTALED $437,500

Bids for the 29.5-mile project were opened May 8, 1946, and the contract was awarded June 6th to D. Gerald Bing and E. B. Bishop. The cost of the project, including construction engineering, is $437,500.50. This is financed by $324,532 federal and state aid funds, $101,168 Chapter 20 funds, and $11,800.50 provided by Modoc County. The work done by the county in constructing grade, drainage structures, and gravel base has a value of approximately $70,000.

Thus Modoc County, by its eagerness to help itself, earns and deserves its position as a leader among the counties of the State in taking full advantage of the opportunity to obtain a road improvement of great benefit to the residents of Surprise Valley.

The contract for the project with D. Gerald Bing supervising the grading, and Paul Wilcox supervising the paving for E. B. Bishop was completed late in May. The Resident Engineer for the Division of Highways was Phil F. Duffy. H. C. Amesbury represented the district as Construction Engineer.

MILK GOES OVER RURAL ROADS

Old Bossy has stepped up production! Last year, some 34,677,000 tons of milk were hauled over rural roads on the journey to milk plants and dealers, according to a report from the Public Roads Administration.

She—"You not only have broken my heart, but you have spoiled my entire evening."

Irate wife (at 2:30 a.m.)—"I want an explanation and I want the truth."

Husband—"Which do you want first?"

Marysville-Yuba City Bridge Soon to be Completed

(Continued from page 21)

tion. When needed it is loaded onto a truck and trailer by means of a Lima "1001" Crane with 65-foot boom and capable of lifting 45 tons at 12 feet. The truck hauls the girders to the erection crane where they are picked up by a Manitowoc "3900" Crawler Crane with 83-foot boom (70 tons at 20 feet). After one girder is set in place a second crane, a Manitowoc "2000" Crawler Crane (25 tons at 12 feet) connects a transverse floor beam to the girder to provide lateral support in case of wind and holds it until the opposite girder is erected and landed.

One timber falsework tower is placed in each span to support the girder until the splices can be pinned and bolted to support the loads. The balance of the floor beams, brackets, lateral bracing and stringers are filled in as required or received.

The rivet gangs follow along as fast as possible. The contractor has not been able to get more than six rivet gangs working at once. All together there are about 80 men employed on the structural steel work.

Steel erection should be completed during June and the riveting about July 1, 1947.

A reinforced concrete deck is being placed on the structural steel. Deck form panels are prefabricated in a mill near the site and are trucked to the bridge. After the forms are adjusted and blocked, the reinforcing steel is placed. Then the screeds are set and concrete runways placed.

Concrete aggregate is manufactured from Yuba River gravel at Hallwood Gravel Plant and batch weighed at the L. L. Rice Plant in Marysville. The batched material is trucked to a two-cubic yard Mixermobile at the bridge where it is mixed and placed in two one-cubic yard buckets. A Bay City truck crane hoists the one-cubic yard batch to a hopper on top of the bridge. Concrete buggies transport the concrete to the section being placed, where it is deposited, struck off and finished. Curing is by water sprinklers.

The first deck concrete was placed May 12, 1947, and it is planned to complete the concrete work by August 1st. A steel railing will be erected on each side of the bridge. Electric street lights will be installed.



These photographs show narrow existing bridge across the Feather River connecting Marysville and Yuba City, which will be replaced by new structure

After the deck concrete has cured, the forms will be removed from underneath and the structural steel will be painted. The final coat will be aluminum paint.

The bridge will be complete September 1, 1947.

The structures were designed by the Bridge Department of the Division of Highways and the approaches by the District Office in Marysville. Harry Carter was Resident Engineer on the Substructure and the author is Resident on the Superstructure. The Contractor is J. H. Pomeroy & Co., Inc., of San Francisco.

Father—"When I was a little boy I always ate the crusts of my bread."
Willie—"Did you like them?"
Father—"Of course I did."
Willie—"Then you may have mine."

A Bridgeman Tex got to the Pearly Gates. St. Peter told him he didn't have room for him. Tex thought a few minutes and said "St. Peter are any of my buddies there?"

St. Peter said, "Why sure."

Tex: "Would you mind sending in a message for me?"

St. Peter: "I'd be glad to."

Tex: "Tell them there's an overtime job in Hell."

A few minutes later there was a rush of bridgemen headed for Hell, with Tex about to follow.

St. Peter to Tex: "There's room now."

Tex: "I better follow them there, might be something in that rumor."

Sign on a display of tomatoes in a vegetable market: "Don't squeeze me till I'm yours."

U. S. 299 Improved to Facilitate Movement of Needed Lumber

By L. R. REDDEN, District Office Engineer

THE UNPRECEDENTED demand for lumber required for housing has given rise to a vast increase in the logging and lumbering industry in northwestern California during the postwar years. Numerous sawmills, both large and small, for producing lumber, plywood, shingles and other similar products have sprung up and are in production; and other mills are in the process of building.

Much of the hauling of the needed logs is being done over secondary roads, often where grades are steep and the roadbed narrow and winding. One of these roads is the state highway (U. S. 299) between Arcata on Humboldt Bay and Willow Creek, 44 miles easterly.

This route is the only feasible outlet to markets from a hinterland of perhaps 2,500 square miles, much of which is virgin timber land. From this area it is estimated that 96,000,000 board feet of lumber were produced and hauled over this route during 1946. This amount of lumber would be enough to build some 9,600 five-room houses.

MAD RIVER BRIDGE

The importance of the log and lumber production of the area was recognized by the government during the war when a weak bridge on the route necessitated a detour of two miles over a very narrow, poorly surfaced county-constructed road in the State's Highway System. War restrictions prevented replacement of the weak bridge, but authority was received to improve the two-mile detour to provide a satisfactory facility for the transportation of logs. The replacement of the weak bridge, which spans Mad River, is now under way.

The government further recognized the importance of the area's contribution to the war effort by authorizing in 1944 the resurfacing of a 5.1 mile section between Mad River Bridge and Blue Lake.

This route was taken into the highway system in 1915. The route of travel at that time was via Bald Mountain, which required several miles of out-of-direction travel. Following World War I, Humboldt County constructed a road along the present route to tap a vast area of untouched timber land. Construction followed the general route of the old Lord-Ellis trail, and it was inevitable that the new road would be known by the same name.



Logging trucks waiting to pass through highway widening operations on U. S. 299, east of Blue Lake



Typical of heavily loaded logging trucks crossing suspension bridge across North Fork of Mad River on U. S. 299. This route is used extensively in hauling logs from forest to mills in Humboldt Bay area

POOR SECTION OF ROUTE

For reasons that should be obvious, the name soon degenerated into the "Lord Helpus" Road. After its completion, the road was subsequently taken over and maintained as a state highway. Except for maintenance, oiling and elimination of minor bridges, the route has remained essentially as county constructed.

Surfacing on that part of the route between Blue Lake and Redwood Creek, a 16.4 mile section, fell into a bad state during World War II, due to unavoidably inadequate maintenance. The bituminous surface disintegrated so far that as much as 75 percent of the road consisted of no more than an unoiled, rough gravel. In addition, the roadbed was narrow and curvature excessively sharp for the long logging truck and trailer combinations using it. One particularly bad section contained three hairpin turns on 30-foot radius and 180 degree central angle. Maximum grades prevailed over much of the section. All these conditions made for hazardous driving, high maintenance of logging equipment, and slow speeds, all of which had the effect of preventing a badly needed increase in the output of logs reaching the mills on Humboldt Bay.

MOVEMENT OF LUMBER

In an effort to help expedite the movement of logs from forest to mill, Humboldt Bay logging interests appealed to the Federal Housing Administration during the summer of 1946 for funds to alleviate the most glaring of the deficiencies in the route. It was intended that the narrow roadbed would be widened to provide an adequate 26-foot width for two lanes of traffic; that the sharpest turns, particularly the three hairpin turns, would be eased off so the logging trucks could get around them with less difficulty; and that the existing weak base and surfacing would be thickened, widened, and oiled to withstand the very heavy loads of logs being hauled over it.

By so doing, it was the belief of the logging interests that the improved road would encourage producers to increase their logging production as much as 40 percent during 1947, or from 96,000,000 board feet in 1946 to an estimated 132,000,000 in 1947.

FUNDS MADE AVAILABLE

As a result of the appeal, the Federal Housing Administration made available in August, 1946, the sum of

$182,500. To this amount the State added a like amount, making a total of $365,000 available for the improvement.

Due to the lateness of the season, and the urgency of getting the work under way as soon as possible, time was not available for the preparation of contract plans, and it was accordingly decided to proceed with the grading involved in the widening by using state forces. This was to be followed by a contract for furnishing and placing of base material, for which no formal plans were required. Upon the base material a double seal coat was to be constructed by state forces.

Work on widening operations got under way on the easterly 4.7 miles of the project between Redwood Summit and one mile east of Redwood Creek late in August, 1946. It was believed that this length was the maximum that could be improved before winter weather set in. Improvement of the three hairpin turns was undertaken first, as they were by far the most difficult places for loaded trucks to negotiate. Local realignments at each turn were made; on two of them the existing 30-foot radii were increased to 60 feet; on the third, a 45-foot radius was the maximum that could be obtained without very heavy cost.



Large logging trucks occupy much of the available roadway width in negotiating the numerous sharp curves and steep grades on this route

PROJECT STARTED

Widening of the existing roadbed, varying from 0 feet to 10-12 feet, then continued on the remainder of the unit until completion of grading late in December, when weather conditions caused a shutdown in these operations.

The progress of the work was hampered to a considerable extent by the difficulty in obtaining both labor and equipment. It had been planned to overcome this anticipated difficulty by using, in part, prison labor from a nearby prison camp, but federal regulations prevented it.

Work on the contract for furnishing and placing the base material on the easterly 4.7 mile unit got under way early in November, 1946, and continued, with less weather delays than anticipated, to completion early in February, 1947. The material consisted of a mixture of river gravel and quarry rock, blended together during crushing and screening operations. The blended material was hauled to the grade and spread and rolled to a compacted thickness of seven inches, except that a thickness of nine inches was spread at the three hairpin turns.

With the completion of the base on the unit all construction work was suspended until the following season.

OPERATIONS RESUMED

Widening operations were resumed in early April, 1947, on the westerly 11.7 miles of the project, and are still under way. The operations are similar to those of the easterly unit, except on the westerly two miles where existing conditions generally are comparatively satisfactory, and it is planned to do no work other than constructing a seal coat.

On the westerly unit a contract for furnishing and placing base material is also under way, with the placing following behind the completed grading. The contract also calls for the furnishing and stockpiling of screenings for the seal coat to be placed upon the base material. This phase of the contract is now complete.

Construction of the seal coat on the easterly 4.7 mile unit is now under way by state forces. Seal coating of the westerly 11.7 mile unit will be undertaken later in the season.

It is expected that grading operations by the State will be completed about August 1st. The placing of the base material by contract is scheduled for completion during the latter part of August; and the placing of the seal coat, which will complete the entire project, should be completed late in September.

The cost of the completed contract work on the easterly 4.7 mile unit was $59,972; the contract bid for the westerly 11.7 mile unit is $98,320. The total contract-performed work will cost, with contingencies, approximately $160,000; and that work being done by state forces will cost approximately $188,000. The balance of the available funds, or $17,000, is reserved for contingencies and engineering.

W. C. Railing of Redwood City, California, is the Contractor for both contracts; J. G. Strand is the Superintendent for the State on the widening operations. L. L. Spinney is Resident Engineer for both the contract and state-constructed parts of the work. The project is located in the Eureka District of the California Division of Highways, for which C. P. Sweet is the Construction Engineer, and G. F. Hellesoe is District Engineer.

John L. Piper Retires

IN 1912, in the formative period of the State Highway Department, John L. Piper became an employee of the agency that was later to become the present day Division of Highways. On June 30th he will retire after 33 years of service. He has been district construction engineer for the division with headquarters at Marysville for the past three years.

Mr. Piper came to California in 1907 and went to Mexico for one year for the Southern Pacific Company on a railroad building project. He entered the employ of the State Highway Department in 1912 and with the exception of one year, which he spent in an engineering capacity in Stanislaus County, he has been employed continuously by the State. He was first stationed in Modesto, later transferred to Sacramento and then to Marysville.

Mr. Piper was married in 1913 to Agnes Macy of San Jose. They have two sons, Donald of San Francisco, and Lacey, an engineer with the Tidewater Associated Oil Company.

Mr. Piper will celebrate his sixty-fifth birthday on June 28. He and Mrs. Piper will move to Carmel to make their home.



Partially completed widening operations on U. S. 299 between Blue Lake and Redwood Summit. When completed an adequate two-lane roadway will be available

Ford Chatters Goes Back To Personnel Board

IN ORDER to accept appointment by Governor Earl Warren as a member of the State Personnel Board, Ford A. Chatters resigned as Secretary of the California Highway Commission. He was named for a 10-year term on the Personnel Board, of which he was a member from April, 1943, to February, 1946, during the absence of Harry Lutgens, who was on military leave.

Chatters is missed by all the members of the Highway Commission. Since 1916, Chatters has been a newspaper publisher in Lindsay, California. He was a member of the Assembly of the State Legislature during the sessions of 1933 and 1935; is a former member of the State Board of Education; Past Commander of Lindsay Post 28, American Legion; and a past president of the California Newspaper Publishers Association. He served overseas in World War I.

Thirty-Five Miles per Hour Speed Limit Solves Problem

(Continued from page 17)

ess of designing a progressive traffic signal system by which the speed and flow of vehicles can be more closely controlled. This system will control the speed of vehicles in the existing zone and will also extend northward through the Cities of Millbrae, San Bruno and South San Francisco, and southward through San Jose. Time space diagrams are being prepared with a regulating speed as close as possible to the present 35 m.p.h.

When finally completed, the traveling public will be able to take advantage of a systematically controlled traffic flow extending along El Camino Real for a distance of 50 miles.



Looking south from Weather Station, Santa Margarita Valley, showing physical separation of lanes by means of curbs.

Modernization of Coast Highway

(Continued from page 8)

The spreader was adapted for the work by installing rubber tired wheels which supported the cut-off screed on the header boards and by disconnecting the vibratory mechanism. This gave positive control of the depth of spread as gauged by the header boards. Very accurate work was obtained by this method and no cutting or shaping of the subgrade was necessary after the spreading and rolling of the cement treated base.

The article in the previously mentioned issue of the magazine emphasized that the elimination of the cutting or shaping operation in placing cement stabilized base would add greatly to the quality of workmanship. The elimination of this operation was accomplished with the Barber-Greene adaptation, as described, and the method is now being used on other current contracts in this district.

SAVING OF EXPENSE

This method does not solve the problem of cutting or shaping where the water and cement are injected into the aggregate on the grade. Spreading and cutting in these cases will be given further study, although it is believed that, in the future, this method of operation will not be used to any great extent.

In addition to the saving of expense to the contractor due to the decreased number of operations and lessened labor by using the Barber-Greene spreader, it is felt that the reduction in time for the complete cycle of operations as well as the higher standard of workmanship obtained due to the elimination of scars as a result of the cutting, adds greatly to the value of the finished base course and subgrade, insofar as the State is concerned.

Considerable difficulty has always been experienced in securing consistently good consolidation of concrete pavement along the header boards. This was due to dependence on hand spading and thereby the introduction of the human element with its high percentage of failures. A Blaw-Knox concrete spreader was used on the N. M. Ball contract, which carried a vibrating screed on the rear. Two three-fourths inch dowels about five inches in length were welded in a vertical position on the outer ends of this screed. These dowels projected into the freshly poured slab transmitting the vibratory action of the screed into the concrete along the edges, and entirely eliminated any rock pockets. The elimination of two laborers ordinarily assigned to the hand spading resulted in a considerable saving to the contractor.

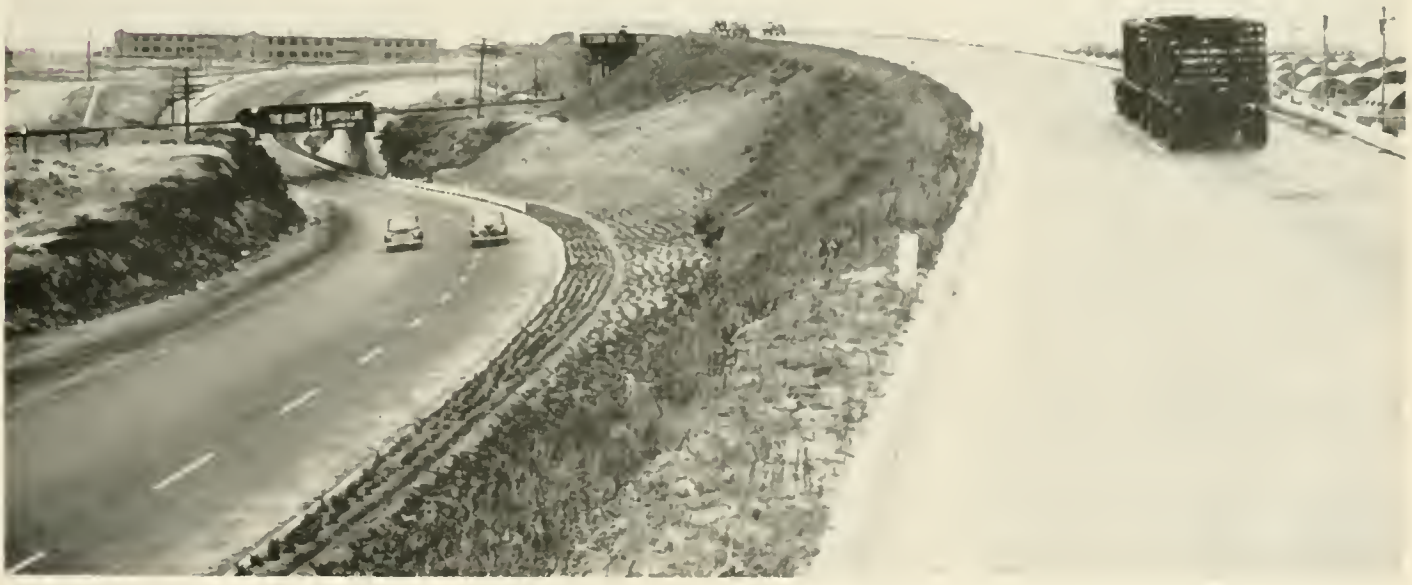
HEAVY TRAFFIC VOLUME

The anticipated decrease in traffic due to the termination of the war and partial cessation of manufacturing activities in the San Diego area has not been experienced and the new section of highway has continued to carry a volume of traffic far in excess of that estimated. With the continued influx of population into San Diego County, the need for expanding the Coast Highway capacity from Del Mar to Oceanside and a connection with the recently completed units is a necessity.

Studies and project reports are now being submitted for reconstructing those portions of this section which are not already a minimum four lanes in width to at least that standard. The areas which are congested to the extent where widening would be impractical are to be bypassed and the new locations are being given consideration for limited access standards.

The construction described and the studies and project reports in process are under the direction of E. E. Wallace, District Engineer, District XI, with headquarters at San Diego.





Upper—Old and new bridges. This view looking south over San Mateo Creek. New bridge on right, old existing structure on left
Lower—Oceanside grade separation, showing three planes of travel

In Memoriam

Arthur Smith Moore

IN A LITTLE over six months after Arthur Smith Moore retired from state service, he was called to the Great Beyond.

Art Moore was born on September 5, 1876, in the little town of San Juan Bautista in San Benito County. His first enterprise was a thriving merchandise store in San Juan, which he operated with his brother.

Seeking wider fields for his endeavors, he first entered state service as a minute clerk in the Legislature in 1913, where he faithfully performed his duties for two sessions.

In 1915, he entered the Highway Department in what was then Division V as a subforeman and helped build the old San Juan Grade. He immediately advanced to what is now known as timekeeper and then to foreman, with headquarters at Salinas. He then transferred to Division IV, where he held the foreman's job at San Mateo where he raised his family.

With the creation of the offices of superintendents, Art Moore took over the Hayward territory, where he stayed until transferred to Ukiah in 1930. In 1934, when the county roads were taken over, he was transferred to Petaluma, where he stayed until his retirement on October 1, 1946, after 33½ years of service.

While recovering from an operation in 1926, he met and married his nurse, Mae Moore, who now survives him.

He was a charter member of Golden Gate Chapter No. 5 and its first delegate to the first CSEA Convention held in Sacramento. He was a Past Master of Texas Lodge No. 46, F. & A. M., a member of the Scottish Rite Bodies in San Mateo, and a member of Islam Temple, A. A. O. N. M. S. He was very active in Masonic affairs and was buried with Masonic honors, with his timekeeper-clerk of recent years officiating.

Death came suddenly on April 12, 1947. The services were held in Mount Funeral Chapel, Petaluma, and his ashes repose in Cypress Lawn Cemetery.

The mortality of mankind is but a part of the process of living—a step on the way to immortality.—Dying, to the good man, is but a brief sleep, from which he wakes to a perfection and fullness of life in eternity.—Tryon Edwards.

James B. Dobson

IN THE death of James B. Dobson on February 24, 1947, his former fellow-employees on the San Francisco-Oakland Bay Bridge lost an old and esteemed friend.

Mr. Dobson was employed as a laborer on the Bay Bridge shortly after its opening date and remained there until he resigned on January 7, 1947, because of poor health. His ready wit and sense of humor were famous throughout the Bay Bridge organization and were one of the reasons for his many friends.

He was born in Philadelphia on September 30, 1893. As a young man he was engaged several years in railroad work, followed by a short period of garage work just prior to World War I.

Mr. Dobson enlisted in the Army on June 4, 1917, and served as a sergeant throughout his entire enlistment period. He served in France in Motor Truck Company No. 381 and was discharged from the Army in June 1919.

After his war service, Mr. Dobson worked as a chauffeur and truck driver for a number of years until February, 1933, when he was first employed by the Division of Highways. For several years he was employed intermittently by the Division until permanently appointed at the Bay Bridge on March 17, 1937.

Mr. Dobson was a member of Crockett Lodge No. 139, F. and A. M., San Francisco.

George Harry Nutting

THE DIVISION of Highways was saddened by the death of George Harry Nutting, who passed away April 27, 1947, following a heart attack.

Harry Nutting was born September 24, 1894, in Yolo County, California, and received his education in the public schools. He was a veteran of World War I and served overseas.

He entered the division's service on December 20, 1920, and in the short space of four years was appointed Maintenance Superintendent at Yreka, Siskiyon County, where he served until his death. The duties of a superintendent in those days were most exacting, and much depended on the inventive genius and untiring energy of the individual. Equipment was inadequate and money lacking for proper road improvement. Notwithstanding these handicaps, Harry —as he was known to everyone—rendered the public an outstanding service. His untiring efforts and innate honesty of purpose won the loyalty and confidence of both his fellow employees and the public.

The division has lost a faithful and valued employee, and takes this occasion to express deepest sympathy for his widow, Mrs. Marguerite Toms Nutting.

Fred George Knell

THE EMPLOYEES of the San Francisco-Oakland Bay Bridge announce with deep regret the sudden death of Fred George Knell at his home in San Francisco on February 9, 1947, at the age of 46 years.

Mr. Knell had been employed as a Toll Collector on the San Francisco-Oakland Bay Bridge since October 10, 1940. In all of his contacts and relations with his fellow employees and with the public, his keen sense of humor and helping hand were never known to fail, and especially during the turmoil of the war years, his aid was invaluable in lightening the burden of many trying situations.

He was born in San Francisco on January 16, 1901, the son of a pioneer family well known in the entertainment and musical circles of that city. For the greater part of his life he resided in the home town he loved so well and enjoyed living in the inimitable way characteristic of true San Franciscans.

Graduating from San Francisco Polytechnic High School in 1917, Mr. Knell was employed as a salesman for various firms in San Francisco and in Sacramento before his employment on the Bay Bridge. He was a member of Sacramento Lodge No. 40, F. & A. M.

Mr. Knell is survived by his wife, Ruby F. Knell, and his son, Frederick Gerald Knell of Los Angeles, to whom deepest sympathy is extended.

G. S. Johnson

GROVER Shirley Johnson, Highway Maintenance Foreman of the Division of Highways, with headquarters at Gilroy, in District IV, died suddenly on May 2, 1947.

Mr. Johnson was a native of Los Gatos and resided in Santa Clara County most of his life, with a short interval of time in which he served in World War I. He was a member of the American Legion Post 217, Gilroy.

Shirley was a faithful and trusted employee of the Division of Highways for 28 years and the principal portion of that time was spent in the maintenance of state highways in the southerly portion of Santa Clara County.

He will be greatly missed by those under whose direction he worked and by all others with whom he came in contact.

Surviving is his widow; also, two stepchildren, George Pimentel of Millbrae and Mrs. Evelyn Tate of San Francisco; and the following brothers and sisters: Gertrude Pimentel of San Jose, Eda Burke of San Jose, Joseph Johnson of San Jose, Albert Johnson of Salinas, Bessie Bowen of Gilroy, Walton Johnson of Gilroy, Mrs. Mabel Murray of Morgan Hill and Arthur Johnson of Red Bluff.

Highway Bids and Contract Awards for April and May 1947

April, 1947

ALAMEDA COUNTY—On San Francisco-Oakland Bay Bridge approach, right of way fence between Toll Plaza and Distribution Structure District IV, Route 5. Anchor Post Products, Inc. of California, San Francisco, $4,577.29; The California Wire Cloth Corp., Oakland, $4,655.56. Contract awarded to Cyclone Fence Division American Steel & Wire Co., Oakland, $4,511.31.

COLUSA COUNTY—Across Sacramento River at Colusa, the existing bridge to be repaired. District III, Route 758. A. Soda & Son, Oakland, $144,247.84; Johnson Western Co., Alameda, $119,855; E. B. Bishop, Orland, $189,565; M. & K. Corporation, San Francisco, $204,009.50. Contract awarded to Lord & Bishop, Sacramento, $136,165.

CONTRA COSTA COUNTY — Across Pacheco Slough near Avon, a steel plate girder swing bridge with reinforced concrete approach spans to be constructed. District IV, Route 797. Dan Caputo, San Jose, $240,980; Guy F. Atkinson Co., South San Francisco, $245,952.50; A. Soda & Son, Oakland $248,999.34; H. F. Lauritzen, Pittsburg, $256,034.22; United Concrete Pipe Corp., Baldwin Park, $257,469; Fredrickson & Watson Const. Co., Oakland, $263,033.70; Butte Construction Co., San Francisco, $289,680.42; Healy Tibbitts Construction Co., San Francisco, $297,290. Contract awarded to The Duncanson-Harrelson Co., San Francisco, $226,434.

FRESNO COUNTY — Between Fowler and Calwa Overpass, about 4.8 miles, to be resurfaced with plant-mixed surfacing and between 4.6 miles north of Kings County line and Mountain View Avenue, about 6.4 miles, portions to be widened with untreated rock borders and the entire length resurfaced with plant-mixed surfacing. District VI, Routes 4, 125, Sections B, A. Ted F. Baun, Fresno, $111,085; Valley Paving and Construction Co., Fresno, $117,140; R. M. Price Co., Huntington Park, $115,180; M. J. Ruddy & Son, Modesto, $132,138. Contract awarded to Gunner Corporation, Pasadena, $107,885.

HUMBOLDT COUNTY—Between Greenlaw Bluffs and Scotia, about 3.2 miles, cement treated base to be constructed and surfaced with plant-mixed surfacing and seal coat. District I, Route 1, Section E. Mercer, Fraser Company, Eureka, $90,832; Sheldon Oil Co., Suisun, $93,824; Fairey-Hammond, Inc., San Francisco, $98,635. Contract awarded to Clements & Co., Hayward, $89,295.

TULARE AND KERN COUNTIES — Between Delano and 2.5 miles south of Earlimart, and between 2.1 miles east of Wasco and Famoso, about 8.3 miles to be surfaced with plant-mixed surfacing. District VI, Routes 4, 33, Sections A, D. Contract awarded to Griffith Company, Los Angeles, $80,685.

KERN AND INYO COUNTIES — Between Indian Wells and Little Lake, portions, about 2.7 miles in net length, to be graded, surfaced with plant-mixed surfacing on imported borrow and a steel span bridge on reinforced concrete abutments to be constructed. District IX, Route 23, Sections E, G. Spencer Webb Co., Inglewood, $275,802. Contract awarded to Basich Bros. Construction Co. & Basich Bros., Alhambra, $199,539.

LAKE COUNTY—Across Kelsey Creek at Cobb, a reinforced concrete bridge and approaches to be constructed. District I, Route 89, Sections B, C. A. Soda & Son, Oakland, $36,382.84; J. Henry Harris, Berkeley, $43,225.30; Piombo Construction Company, San Francisco, $56,773. Contract awarded to Arthur B. Siri, Santa Rosa, $31,625.

LASSEN COUNTY — Between 2 miles north of Milford and Bird Flat, about 12.4 miles, to be surfaced with plant-mixed surfacing and shoulders to be constructed of imported borrow. District II, Route 29, Section D. Fredericksen & Kasler, Sacramento, $128,780; A. Teichert & Son, Inc., Sacramento, $137,665; Fairey-Hammond, Inc. & R. A. Farish, San Francisco, $138,965; Isbell Construction Co., Reno, $141,192.50; E. B. Bishop, Orland, $175,000. Contract awarded to Clements & Co., Hayward, $119,825.

LOS ANGELES AND ORANGE COUNTIES—On Firestone Blvd. between Pioneer Blvd. and Lincoln Avenue, about 5.9 miles to be resurfaced with plant-mixed surfacing and imported borrow to be placed on shoulders and bituminous surface treatment applied thereto. District VII, Route 171, Sections B, A. Sully Miller Contracting Co., Long Beach, $87,775; Vido Kovacevich Co., South Gate, $88,855; Oswald Bros., Los Angeles, $89,145; Warren Southwest Inc., Los Angeles, $91,092.50; J. E. Haddock, Ltd., Pasadena, $95,547.50; Griffith Co., Los Angeles, $96,305; W. E. Hall Co., Alhambra, $106,860. Contract awarded to Jesse S. Smith, Glendale, $86,200.

LOS ANGELES COUNTY — Between Citrus Avenue and Grand Avenue, about 1 mile in length, to be resurfaced with plant-mixed surfacing. District VII, Route 9, Section H. Jesse S. Smith, Glendale, $8,630; W. E. Hall Co., Alhambra, $9,432. Contract awarded to Griffith Co., Los Angeles, $7,708.

LOS ANGELES COUNTY—On Santa Ana Parkway, at Euclid Avenue and at Marietta Street in the City of Los Angeles, two reinforced concrete box girder undercrossings and roadway approach embankments thereto to be constructed. District VII, Route 2. Vido Kovacevich Co., South Gate, $266,140; W. J. Disteli, Los Angeles, $271,283.55; Oberg & Cook, Gardena, $265,148.10; J. E. Haddock, Ltd., Pasadena, $289,238.35; Oberg Bros., Inglewood, $291,833.30; The Contracting Engineers Co., Los Angeles, $292,049; C. B. Tuttle Co., Long Beach, $293,016.20; Carlo Bongiovanni, North Hollywood, $296,452.33; Guy F. Atkinson Co., Long Beach, $297,219.50; Peter Kiewit Sons Co., Arcadia, $301,376; Winston Bros., Co., Los Angeles, $303,863.50; Byerts & Dunn, Los Angeles, $312,251.25. Contract awarded to Spencer Webb Co., Inglewood, $253,089.70.

MADERA COUNTY—Across Fine Gold Creek about 34 miles northeast of Madera, a structural steel bridge to be constructed and about 0.2 mile of approaches to be graded. District VI, Route 962. Northup Construction Company, Long Beach, $79,793; Taylor-Wheeler Commercial, Inc., Fresno, $83,483.20; Charles MacClosky Company, San Francisco, $85,924; Ted F. Baun, Fresno, $86,062.50. Contract awarded to Dan Caputo, San Jose, $78,799.

MARIN COUNTY—Between San Rafael and Waldo, about 2.1 miles in net length to be resurfaced with asphalt concrete and shoulders to be constructed with crusher run base and seal coat. District IV, Route 1, Section C. Brown-Ely Co., Contractors, El Cerrito, $76,277.25; E. A. Forde, San Anselmo, $79,158; A. G. Raisch Co., San Francisco, $82,982.75; Chas. L. Harney, Inc., San Francisco, $84,671.50. Contract awarded to Lee J. Immel, San Pablo, $74,603.75.

MENDOCINO COUNTY—Between Hopland and Crawford Ranch, about 6.6 miles cement treated base to be constructed and surfaced with plant-mixed surfacing and seal coat. District I, Route 1, Section B. Sheldon Oil Co., Suisun, $158,937; A. Teichert & Son, Inc., Sacramento, $159,780; A. R. McEwen & C. M. Syar, Willits, $160,408.50; Ted F. Baun, Fresno, $160,590; Parish Bros., Benicia, $176,073.50; Fairey-Hammond Inc. & R. A. Farish, San Francisco, $178,187.50; M. J. Ruddy & Son, Modesto, $178,386.50; Fredericksen & Kasler, Sacramento, $180,187; Chas. L. Harney Inc., San Francisco, $182,474; A. G. Raisch Co., San Francisco, $190,713.75; Fredrickson Bros., Emeryville, $199,336. Contract awarded to Clements & Co., Hayward, $152,760.

MERCED COUNTY—Between Planada and 5.3 miles east, about 5.3 miles in length, untreated rock base to be placed over existing pavement and surfaced with plant-mixed surfacing. District X, Route 18, Section A. Frank B. Marks & Sons, Tracy, $94,095; Browne & Krull, Palo Alto, $98,859; Louis Biasotti & Son, Stockton, $105,572.50; W. C. Railing, Redwood City, $115,615. Contract awarded to M. J. Ruddy & Son, Modesto, $84,373.

PLACER COUNTY—At Nevada Street and in the vicinity of East Street Undercrossing, a highway lighting system to be furnished and installed. District III, Routes 17, 37, Section B. Aub. H. W. Ruby, Sacramento, $8,719.42. Contract awarded to L. H. Leonardi Electrical Construction So., San Rafael, $6,000.

PLUMAS AND LASSEN COUNTIES—Between 0.3 mile west and 0.8 mile east of Plumas-Lassen County line, about 1.1 miles in length, to be graded, surfaced with plant-mixed surfacing and seal coats applied thereto. District II, Route 29, Sections A, A. Piombo Construction C., San Francisco, $87,954.50. Contract awarded to Fredrickson & Watson Construction Co., Oakland, $81,964.75.

RIVERSIDE COUNTY — Between 1.9 miles west of Palowalla and 3.9 miles west of Blythe, and between 3.6 miles north of Imperial County line and 1.8 miles south of San Bernardino County line, a net distance of about 12.3 miles to be repaired by placing road-mixed surfacing over the existing surfacing and a portion to be repaired with imported base material and road-mixed surfacing. District XI, Routes 61, 146, Sections E, ABCDE. Arthur A. Johnson, Laguna Beach, $70,694; Geo. Herz & Co., San Bernardino, $74,822; Tanner Construction Co., Phoenix, $83,890 Contract awarded to MacArthur & Son, Palmdale, $56,689.

SAN BERNARDINO COUNTY—At San Timoteo Creek and Santa Ana River on Waterman Avenue between Riverside-Redlands Road and Mill Street, two steel beam span bridges to be constructed and about 2.7 miles to be graded and surfaced with plant-mixed surfacing. District VIII, Route 712. George Herz & Co., San Bernardino, $392,501.70; Spencer Webb Co., Inglewood, $397,704.90. Contract awarded to Griffith Co., Los Angeles, $372,811.65.

SAN DIEGO COUNTY—At Dulzura Creek about 5 miles south of Jamul, a net distance of about 0.3 mile to be graded and bituminous surface treatment to be applied, and a reinforced concrete bridge to be constructed. District XI, Route 200, Section B.

Northup Construction Co., Long Beach, $82,923; Walter H. Barber, La Mesa, $86,957.65; Carroll & Foster, San Diego, $99,711.50; Oberg & Cook, Gardena, $103,450; Spencer Webb Co., Inglewood, $105,711; O'Brien & Bell Construction Co., Santa Ana, $110,781; E. S. & N. S. Johnson, Fullerton, $114,209; C. B. Tuttle Co., Long Beach, $122,471.90. Contract awarded to Griffith Co., Los Angeles, $77,665.50.

SAN DIEGO COUNTY—In the City of San Diego, between "A" Street and 0.4 mile south of Mission Valley Road, about 2.9 miles to be planted and a sprinkling system to be furnished and installed. District XI, Route 77. Leonard Coats Nurseries, Inc., San Jose, $71,624.92; Milton P. Sessions, Inc., La Jolla, $78,635.88; Walter Anderson Nurseries, San Diego, $112,775.64. Contract awarded to Jannock Nurseries, Altadena, $68,683.40.

SAN JOAQUIN COUNTY—Between Middle River and Holt, about 4.4 miles to be surfaced with plant-mixed surfacing on untreated rock base. District X, Route 75, Section A. Asta Construction Company, Rio Vista, $99,834; A. Teichert & Son, Inc., Sacramento, $99,950; Louis Biasotti & Son, Stockton, $109,867; Fredrickson & Watson Construction Co., Oakland, $118,015.75. Contract awarded to M. J. B. Construction Co., Stockton, $93,715.

SAN JOAQUIN COUNTY—Across Mokelumne River about 5 miles northwest of Lodi, a structural steel and reinforced concrete bridge to be constructed. District X, Route 901. Dan Caputo, San Jose, $161,922; Charles MacClosky Company, San Francisco, $167,883; Lord & Bishop, Sacramento, $170,672; A. Soda & Son, Oakland, $173,789.84; Fredrickson & Watson Construction Co., Oakland, $178,848.05; Pomeroy Sinnock, Stockton, $193,575; Macco Corp., Clearwater, $197,404; Butte Construction Co., San Francisco, $230,815.35. Contract awarded to A. A. Edmondson & A. L. Miller, Sacramento, $159,071.50.

SAN LUIS OBISPO COUNTY—Between State Route 137 and Rinconada-Las Pilitas Road, about 6 miles to be graded and imported base material placed thereon. District V, Route 1086. Frank T. Hickey, Inc., Los Angeles, $57,057.20; Miles & Bailey & Harms Brothers, Madera, $58,854.98; A. Madonna, San Luis Obispo, $59,801.80; Brown-Doko, Pismo Beach, $68,343.70; Silva & Hill Construction Co., Los Angeles, $78,457.60; George E. Murray, Stockton, $79,994.80; S. Edmondson & Sons, Los Angeles, $87,030.70; Dimmitt & Taylor, Los Angeles, $88,877.10; Henry C. Dalessi, San Luis Obispo, $91,259.50; Bonadiman-McCain, Inc., Los Angeles, $95,189.06; Rexroth & Rexroth, Bakersfield, $97,452.50; Granite Construction Co., Watsonville, $100,844.40. Contract awarded to Nathan A. Moore, San Gabriel, $49,659.30.

SAN LUIS OBISPO COUNTY—On Oso Flaco-Nipomo Road, between Southern Pacific Railroad and 3.2 miles easterly, about 3.2 miles to be graded, imported borrow to be furnished and placed, bituminous surface treatment to be applied to central portion thereof and seal coat applied thereto, and penetration treatment applied to shoulders. District V, Route 683. A. A. Edmondson, Glendale, $51,628.45; Brown-Doko, Pismo Beach, $53,523.25; Browne & Krull, Palo Alto, $55,316; Nathan A. Moore, San Gabriel, $56,691.80; Frank T. Hickey, Inc., Los Angeles, $59,354.20; MacArthur & Son, Palmdale, $63,231.75; Dimmitt & Taylor, Los Angeles, $67,711; Granite Construction Co., Watsonville, $69,987.30. Contract awarded to A. Madonna, San Luis Obispo, $50,890.70.

SAN MATEO COUNTY—On Bayshore Freeway in the City of South San Francisco, three bridges and the substructures for two railroad overheads to be constructed. District IV, Route 68. Carrico & Gantier, San Francisco, $421,905.35; Dan Caputo & Edward Keeble, San Jose, $439,938.35; Carl N. Swenson Co., San Jose, $457,544.20; Guy F. Atkinson Co., South San Francisco, $465,861.60; Barrett & Hilp, San Francisco, $473,308.20; Chas. L. Harney, Inc., San Francisco, $492,925.80; M & K Corporation, San Francisco, $498,159.35; Eaton & Smith, San Francisco, $573,878. Contract awarded to Peter Sorensen and Harry J. Oser, Redwood City, $412,331.55.

SANTA BARBARA COUNTY—Between 2.6 miles east of Buellton and Grand Avenue, about 2.3 miles in net length to be graded and surfaced with road-mixed surfacing on crusher run base. District V, Route 149, Section D. Granite Construction Co., Watsonville, $121,607; Brown-Doko, Pismo Beach, $129,272.25; A. Madonna, San Luis Obispo, $130,274; N. M. Ball Sons, Berkeley, $132,115.90; Fredericksen & Kasler, Sacramento, $138,575; Dimmitt & Taylor, Los Angeles, $138,802; Heuser & Garnett, Glendale, $152,444; L. A. & R. S. Crow, Los Angeles, $156,204; George von KleinSmid, Bakersfield, $160,046; Silva & Hill Construction Co., Los Angeles, $174,002. Contract awarded to Frank T. Hickey, Inc., Los Angeles, $119,782.95.

SANTA CLARA COUNTY—About 1¼ miles west of Merced County line, about 0.1 mile in length to be graded and bituminous surface treatment applied. District IV, Route 32, Section C. Contract awarded to Granite Construction Co., Watsonville, $10,718.

SOLANO COUNTY—Across Pleasants Creek, Alamo Creek, and tributary to Putah Creek, between 1.5 and 14 miles northwest of Vacaville, 5 bridges to be constructed. District X, Routes 1106, 1108, 1110. Dan Caputo, San Jose, $86,766; Erickson, Phillips & Weisberg, Oakland, $88,860.20; Charles MacClosky Co., San Francisco, $89,499; Chittenden & Chittenden, Auburn, $93,451; Ted F. Baun, Fresno, $98,413; A. L. Miller, Sacramento, $99,186; Carl N. Swenson Co., San Jose, $105,418; Klay-Bennett Construction Co., Palo Alto, $109,721; E. H. Peterson & Son, San Pablo, $119,269; Northup Construction Co., Long Beach, $119,328; Butte Construction Co., San Francisco, $126,684. Contract awarded to G. M. Carr & Bati Rocca, Santa Rosa, $85,420.

SOLANO AND SACRAMENTO COUNTIES—Repairing a bridge across Sacramento River at Rio Vista. District X, Route 53, Sections C, A. Evans Construction Co., Berkeley, $6,991; Fred Kaus, Stockton, $7,539; C. C. Gildersleeve, Marysville, $9,778; A. Soda & Son, Oakland, $14,830.84. Contract awarded to C. M. Allen, Fairfield, $3,540.

SONOMA COUNTY—Between 3 miles north of Petaluma and 1 mile south of Petaluma, about 4 miles to be resurfaced with asphalt concrete and shoulders to be constructed with crusher run base and seal coat. District IV, Route 1, Section C. Brown-Ely Co., Contractors, El Cerrito, $87,035.55; E. A. Forde, San Anselmo, $97,911.75; Arthur B. Siri, Santa Rosa, $109,633.31; M.J.B. Construction Co., Stockton, $101,833; Chas. L. Harney, Inc., San Francisco, $105,435.20; Lee J. Immel, San Pablo, $108,344.60; A. R. McEwen and C. M. Syar, Vallejo, $112,159.10. Contract awarded to A. G. Raisch Co., San Francisco, $85,911.28.

STANISLAUS AND SAN JOAQUIN COUNTIES—About 8 miles northwest of Modesto, a steel bridge across Stanislaus River to be constructed. District X, Route 4, Sections B, A. A. Soda & Son, Oakland, $353,765.84; Macco Corporation, Clearwater, $354,449; Erickson, Phillips & Weisberg, Oakland, $355,353.90; Spencer Webb Co., Inglewood, $383,586. Contract awarded to Fredrickson & Watson Construction Co., Oakland, $341,807.82.

TEHAMA COUNTY—Between Mill Race Creek and Red Bluff, about 2.8 miles, to be graded, surfaced with plant-mixed surfacing on crusher run base and on existing pavement. District II, Route 3, Section D. Fredrickson Bros., Emeryville, $130,127.30; H. Earl Parker & Clements & Co., Marysville, $136,209.50; A. Teichert & Son, Inc., Sacramento, $137,457.50; Fairey-Hammond, Inc., & R. A. Farish, San Francisco, $139,854; A. A. Edmondson, Glendale, $143,244.40; Browne & Krull, Palo Alto, $145,461.50; N. M. Ball Sons, Berkeley, $147,488.25; E. B. Bishop, Orland, $184,294. Contract awarded to Morrison-Knudsen Co., Inc., San Francisco, $123,009.25.

YOLO COUNTY—Between 1¼ miles north of Solano County line and Woodland, and between 3¾ miles north of Woodland and 1 mile south of Knights Landing, a net length of about 9.2 miles to be repaired with plant-mixed surfacing and seal coat. District III, Routes 7, 87, Section A, Wd. A. Sheldon Oil Co., Suisun, $92,690; A. Teichert & Son, Inc., Sacramento, $96,152.25; Fredrickson Bros., Emeryville, $98,597; Fredericksen & Kasler, Sacramento, $114,053.70; Fairey-Hammond Inc. & R. A. Farish, San Francisco, $117,558.25. Contract awarded to McGillivray Construction Co., Sacramento, $81,128.75.

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ALAMEDA COUNTY — Between San Miguel Avenue and Parkway in Castro Valley, about 0.4 mile, a storm drain to be constructed. District IV, Route 5, Section B. F. J. O'Shaughnessy, San Francisco, $22,350.60; J. Henry Harris, Berkeley, $25,057; Underground Construction Co., Oakland, $25,491.35. Contract awarded to McGuire & Hester, Oakland, $22,061.40.

FRESNO COUNTY—On Reed Avenue between Manning Avenue and Route 41, about 8 miles to be graded, plant-mixed surfacing to be constructed on bituminous treatment and penetration treatment applied to shoulders. District VI, Route 823. Louis Biasotti & Son, Stockton, $208,966.50; F. Gunner Gramatky, Fresno, $222,900; Brown & Doko, Pismo Beach, $227,055.50; R. M. Price Co. & Rex B. Sawyer, Huntington Park, $228,673.50. Contract awarded to A. Teichert & Son, Inc., Sacramento, $206,530.50.

FRESNO AND KINGS COUNTIES—Across Kings River near Hardwick, a reinforced concrete girder bridge to be constructed. District VI, Route 623. Ted F. Baun, Fresno, $145,179; O. B. Pierson, Bellflower, $161,060; Charles MacClosky Company, San Francisco, $171,789; Northrup Construction Co., Long Beach, $178,435; Bent Construction Company, Los Angeles, $183,670. Contract awarded to Klay-Bennett Construction Co., Palo Alto, $141,867.50.

FRESNO AND MADERA COUNTIES—Across San Joaquin River and Overflow at Firebaugh, two steel beam bridges to be constructed. District VI, Route 811. A. Soda & Son, Oakland, $285,674.84; Dan Caputo, San Jose, $287,654; Erickson, Phillips and Weisberg, Oakland, $303,006.30; Macco Corp., Clearwater, $308,210; Bent Construction Co., Los Angeles, $314,314; Granite Construction Co., Watsonville, $337,402.50; Fredrickson Bros., Emeryville, $359,855.75. Contract awarded to Charles MacClosky Co., San Francisco, $253,917.30.

HUMBOLDT COUNTY—Across Klamath River, at Weitchpec, the substructure for a bridge to be constructed and about 0.5 mile of approaches to be graded and surfaced with imported base material. District I, Routes 84 and 46, Sections B, CD. Mercer, Fraser Company, Eureka, $299,644. Contract awarded to Clifford A. Dunn, Klamath Falls, Oregon, $260,602.40.

KERN COUNTY—Between Muroc Junction and 6.5 miles east, about 6.5 miles to be surfaced with road mixed surfacing. District IX, Route 58, Section B. Contract awarded to Basich Bros. Construction Co. & Basich Bros., Alhambra, $30,265.

IMPERIAL COUNTY—Between El Centro and Brawley, about 13.1 miles to be graded and surfaced with plant mixed surfacing on cement treated base. District XI, Routes 12, 26, Sections C, ECn, F, Imp. G., Brw. R. E. Hazard Contracting Co., San Diego, $1,168,861.80; Winston Bros. Co., Los Angeles, $1,182,930.80; Morrison Knudsen Co. Inc., Los Angeles, $1,187,061; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $1,194,584.20; Fredericksen & Kasler and E. B. Bishop, Sacramento, $1,553,509.70; Peter Kiewit Sons Co., Arcadia, $1,603,817.30. Contract awarded to Basich Bros. Construction Co. & Basich Bros., Alhambra, $1,131,227.80.

INYO COUNTY—Between Route 23 and Mono County Line, in Bishop between West City Limits and Route 23, and between Route 23 and Keeler, about 3.2 miles in length to be surfaced with road-mixed surfacing. District IX, Routes 76, 127, Sections A, Bis., C. Basich Bros. Construction Co. & Basich Bros., Alhambra, $23,592; Oilfields Trucking Co., Bakersfield, $24,287.50; Geo. E. France, Visalia, $26,871.10. Contract awarded to Browne and Krull, Palo Alto, $16,463.40.

INYO COUNTY—Near Bishop, on Warm Springs Road and Poleta Road, a net distance of about 4.4 miles to be graded and penetration treatment to be applied thereto and two timber trestle bridges to be constructed. District IX, Route 1070, Nevada Constructors, Inc., Reno Nevada, $119,545.33; Bonadiman McCain Inc. Los Angeles, $138,481.40; MacDonald & Kruse and Hensler Construction Corporation, Glendale, $143,176.20; Maceo Corporation, Clearwater, $156,139.10. Contract awarded to Basich Bros. Construction Co. & Basich Bros., Alhambra, $117,702.20.

KERN COUNTY—On Comanche Drive, between State Route 58 and 3.3 miles southerly, about 3.3 miles to be graded, bituminous surface treatment to be applied to the central portion and penetration treatment to the shoulders. District VI, Route 881, Rand Construction Co., Bakersfield, $10,387.10; Oilfields Trucking Company, Bakersfield, $11,203.75; George von Kleinsmid, Bakersfield, $15,948; Griffith Company, Los Angeles, $16,685.90; A. A. Edmondson, Glendale, $18,273.30; Ted F. Baun, Fresno, $19,729. Contract awarded to Rexroth & Rexroth, Bakersfield, $36,734.

LOS ANGELES COUNTY—On Santa Ana Parkway between Aliso and Kearney Streets, interchange roadways between the Aliso Street Viaduct, Ramona Parkway and Santa Ana Parkway, to be graded and paved with Portland cement concrete and asphalt concrete. District VII, Route 2. Peter Kiewit Sons Co., Arcadia, $213,358.25; J. E. Haddock Ltd., Pasadena, $234,877.50; Griffith Co., Los Angeles, $281,369.25; Mike Radich & Co. Burbank, $281,697.85; MacDonald & Kruse-Hensler Const. Corp. Glendale, $280,546.75. Contract awarded to Vido Kovacevich, South Gate, $192,220.75.

LOS ANGELES COUNTY—On Santa Monica Boulevard, between Doheny Drive and La Brea Avenue, furnishing and installing traffic signal systems at 13 intersections and reconstructing traffic signal systems at two intersections. District VII, Route 167, Section A. Ecomolite Corp., Los Angeles, $70,093. Contract awarded to C. D. Draneker Co., Los Angeles, $63,930.

LOS ANGELES COUNTY—On Lakewood Boulevard, between Spring Street and Conant Street, about 0.7 mile in net length, existing shoulders to be reconstructed and surfaced with plant mixed surfacing. District VII, Route 168, Section A. Sully Miller Contracting Co., Long Beach, $30,907; Vido Kovacevich Co., South Gate, $33,291; M. S. Mecham & Sons, Lynwood, $35,251; Cox Bros. Construction Co., Stanton, $35,677; Griffith Co., Los Angeles, $37,072; Catalina Construction Co., Covina, $38,789. Contract awarded to Jesse S. Smith, Glendale, $30,351.

LOS ANGELES COUNTY—At the intersection of Rosemead Boulevard and Broadway, a traffic signal system to be furnished and installed. District VII, Route 168, Section C. Ecomolite Corp., Los Angeles, $11,624; C. D. Draneker Co., Los Angeles, $12,130. Contract awarded to Prescott Electric & Manufacturing Co., Los Angeles, $8,100.

MERCED AND STANISLAUS COUNTIES—Between 3 miles north of Livingston and Stanislaus County line and between Modesto and Empire, a distance of about 8.9 miles to be resurfaced with plant-mixed surfacing. District X, Routes 1, 110, Section D, C. Frank B. Marks & Sons, Tracy, $65,741.50; M. J. B. Construction Co., Stockton, $74,352; E. A. Forde, San Anselmo, $71,590. Contract awarded to M. J. Ruddy & Son, Modesto, $60,968.50.

MODOC COUNTY — Between Lassen County Line and Canby and between 6.8 miles and 7.1 miles northwest of Canby, about 20.8 miles, to be repaired with crusher run base and seal coats. District II, Routes 28, 210, Sections A, A, W, C. Railing, Redwood City $172,565.25; Fredericksen & Kasler and E. B. Bishop, Orland, $183,023. Contract awarded to Harms Bros., Sacramento, $148,631.50.

MONO COUNTY—Between Point Ranch and Bridgeport, about 2.8 miles in length, imported borrow to be placed over existing roadbed and surfaced with road mixed surfacing. District IX, Route 23, Section I. Browne and Krull, Palo Alto, $39,171; Basich Brothers Construction Co. and Basich Brothers, Alhambra, $11,412; Nevada Constructors Inc., Reno, Nevada, $47,219.50; D. Gerald Bing, Sacramento, $58,120. Contract awarded to George E. France, Visalia, $37,872.50.

MONTEREY COUNTY—Between Chualar and 3 miles north, between Salinas and Castroville, and between Werner Hill and Watsonville Junction, about 3.7 miles to be repaired by placing plant mixed surfacing over the existing pavement. District V, Routes 2, 118, 56; Sections B, A, J. A. Teichert & Son, Inc., Sacramento, $27,702. Contract awarded to Granite Construction Co., Watsonville, $22,178.

NAPA COUNTY—On Silverado Trail between 4 miles northeast of Napa and Calistoga, about 1.7 miles to be graded and surfaced with crusher run base and armor coat and a reinforced concrete bridge to be constructed. District IV, Route 607. A. G. Raisch Co., San Francisco, $120,883.50; Harold Smith, St. Helena, $128,887; Asta Construction Co., Rio Vista, $129,315; E. A. Forde, San Anselmo, $130,750.25; A. R. McEwen & C. M. Syar, Willits, $139,647.55; Edmondson & Miller, Sacramento, $139,969.50; Louis Biasotti & Son, Stockton, $152,637.50; Fredrickson Bros., Emeryville, $156,273; J. Henry Harris, Berkeley, $167,063.70; Piombo Construction Co., San Francisco, $224,781.50. Contract awarded to Geo. E. Murray, Stockton, $118,496.50.

SACRAMENTO COUNTY—Between 12 miles east of Sacramento and Riley Street in Folsom, about 5.4 miles in length, plant-mixed surfacing to be placed over existing pavement and on portions of the project imported borrow to be placed on the shoulders. District III, Route 11, Section B. Fel. A. Teichert & Son Inc., Sacramento, $56,832; McGillivray Construction Co., Sacramento, $58,535; Fredericksen & Kasler, Sacramento, $65,938. Contract awarded to Harms Bros., Sacramento, $56,023.

SANTA BARBARA COUNTY—Between 0.2 mile east of Park Place and Ranchería Street in the City of Santa Barbara, about 2.2 miles in net length, a four lane divided highway to be graded and paved with Portland cement concrete on cement treated subgrade, other areas to be surfaced with plant-mixed surfacing on crusher run base and on imported borrow and a reinforced concrete bridge on timber piles to be constructed. District V, Route 2. United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $968,034; J. E. Haddock Ltd., Pasadena, $1,016,291.65; Guy F. Atkinson Co., South San Francisco, $1,055,833.50; A. Teichert & Son Inc. & Dinmitt & Taylor, Sacramento, $1,090,533. Contract awarded to N. M. Ball Sons, Los Angeles, $877,917.50.

SAN BERNARDINO COUNTY—Across Day Canyon Flood Canal, approximately 5 and 7 miles east of Upland, two reinforced concrete slab bridges and approach work to be constructed. District VIII, Route 190, 9, Sections A, A. C. B. Tuttle Co., Long Beach, $78,638.28; Geo. Herz & Co., San Bernardino, $79,983.05; A. R. Coffeen Co., Corona, $82,897.85; Oberg Bros., Inglewood, $85,875.20; Oberg & Cook, Gardena, $89,834.30; E. S. & N. S. Johnson, Fullerton, $91,807.50; Bonadiman-McCain, Los Angeles, $97,103.10. Contract awarded to George W. Peterson, Los Angeles, $72,884.30.

SAN BERNARDINO AND RIVERSIDE COUNTIES—Between east city limits of Upland and 0.6 mile east of Haven Avenue, between 2.1 miles and 0.3 mile west of Riverside, and between Panorama Point and Squirrel Inn, about 10.7 miles in net length to be repaired by placing plant mixed surfacing and seal coat over existing pavement. District VIII, Routes 9, 19, 13, Sections A, A, A, George Herz & Co., San Bernardino, $122,895.15; Griffith Co., Los Angeles, $126,253.80; Jesse S. Smith, Glendale, $129,874. Contract awarded to Matich Bros., Colton, $114,562.

SAN LUIS OBISPO COUNTY—For constructing a bridge across Stenner Creek. District V, California Polytechnic School. Rio Construction Co., Inglewood, $10,445; Dinsmore & McCoy, Santa Barbara, $11,730; Brown-Doko, Pismo Beach, $13,305; A. Madonna, San Luis Obispo, $13,175; Fred D. Kyle Co., Pasadena, $13,700; Ted F. Baun, Fresno, $13,800; Maino Construction Co., San Luis Obispo, $11,199.75. Contract awarded to O. R. Ochs & Son, San Luis Obispo, $9,225.

SAN MATEO COUNTY—At Geneva Avenue near the San Francisco County line and in Brisbane near Visitacion Avenue, portions about 0.6 mile in net length, existing pavement to be widened to provide channelization of intersections and traffic signal systems to be installed. District IV, Route 68, Section A. Eaton & Smith, San Francisco, $79,717. Contract awarded to Chas. L. Harney, Inc., San Francisco, $74,177.30.

SANTA BARBARA AND SAN LUIS OBISPO COUNTIES—Between Zaca and Wigmore and between 11 miles south of Nipomo and Deleissignes Creek, a net distance of about 39 miles, portions to be repaired by placing crusher run base over the existing pavement and surfacing with plant mixed surfacing, and portions to be repaired by placing plant mixed surfacing over the existing pavement. District V, Route 2, Sections C, F, A. Madonna, San Luis Obispo, $128,812; Granite Construction Co., Watsonville, $144,271. Contract awarded to Brown Doko, Pismo Beach, $111,120.

SANTA CLARA COUNTY—Between Alameda County Line and Milpitas, about 1.0 mile to be repaired with crusher run base and asphalt concrete. District IV, Route 5, Sec-

tion A. A. J. Raisch Paving Company, San Jose, $44,367.50; Leo F. Piazza, San Jose $46,844.70. Contract awarded to A. S. Jones Napa, $42,593.

SISKIYOU COUNTY — Across Cottonwood Creek and under the tracks of the Southern Pacific Company about 2 and 5.5 miles north of Hornbrook, respectively, a bridge and an underpass to be constructed. District II Route 3, Section C. Carl N. Swenson Co., Inc. San Jose, $339,347.50; Guy F. Atkinson Company, South San Francisco, $383,040. Contract awarded to Ted F. Baun, Fresno, $319,307.60.

SISKIYOU AND MODOC COUNTIES—Between Route 72, 3 miles north of Dorris and 4 miles west of Hatfield, about 15.6 miles to be surfaced with plant-mixed surfacing and seal coat, and between 2.4 miles north of Stronghold and Oregon State Line, about 7.2 miles to be surfaced with plant-mixed surfacing and seal coat and shoulders to be restored with imported borrow. District II, Routes 753, 210, Sections B. A. Sheldon Oil Company, Suisun, $163,185; Fredericksen & Kasler, Sacramento $185,164.50; Harms Bros., Sacramento, $185,725; The Utah Construction Co., San Francisco, $193,237.25; Frederickson Bros., Emeryville, $247,828. Contract awarded to Fairey-Hammond Inc. and R. A. Farish, San Francisco, $159,675.

SOLANO COUNTY — Between Fairfield and 3.5 miles north and in Vacaville about 4.8 miles in length to be repaired by placing plant-mixed surfacing over the existing pavement. District X, Routes 7, 90, Sections C, Vac. & City St. Parish Bros., Benicia, $35,965; C. M. Syar, Vallejo, $37,906.20; Sheldon Oil Company, Suisun, $38,780.75; Asta Construction Co., Rio Vista, $39,245.50; J. Henry Harris, Berkeley, $42,018.75. Contract awarded to Fredrickson Bros., Emeryville, $28,277.

TULARE COUNTY—Across White River about 7 miles southeast of Earlimart, a reinforced concrete slab bridge to be constructed. District VI, Route 1130, Wm. E. Thomas Construction Co., Sacramento, $15,950; F. Fredenburg, Temple City, $16,290; O. B. Pierson, Bellflower, $18,165; Ted F. Baun, Fresno, $18,560; E. G. Perham, Los Angeles, $18,687; Wheeler Construction Co., Oakland, $23,700; Evans Construction Co. & Barton & Anderson, Berkeley, $23,951.50. Contract awarded to E. H. Peterson & Son, Richmond, $15,940.

TULARE COUNTY — Across St. Johns River, about 5.5 miles east and about 1.5 miles north of Visalia, two reinforced concrete slab bridges to be constructed. District VI, Routes 1136, 1138, Erickson, Phillips & Weisberg, Oakland, $175,258; Ted. F. Baun, Fresno, $189,924; R. M. Price Co. & Rex B. Sawyer, Huntington Park, $190,119; Dan Caputo, San Jose, $198,497; Charles MacClosky Company, San Francisco, $221,778. Contract awarded to Northrup Construction Co., Long Beach, $147,415.

VENTURA COUNTY—Between Oxnard and Big Sycamore Creek about 5.7 miles in length to be resurfaced with plant-mixed surfacing and imported borrow to be placed on the shoulders and bituminous surface treatment applied thereto. District VII, Route 60, Section A. O'Brien & Bell Construction Co., Santa Ana, $89,997.50; Ted F. Baun, Fresno, $91,302.50; MacDonald & Kruse & Hensler Construction Corp., Glendale, $98,187.50; J. E. Haddock, Ltd., Pasadena, $98,745; Griffith Co., Los Angeles, $104,180. Contract awarded to Baker & Pollock, Ventura, $87,925.

VENTURA COUNTY — Between Ellsworth Barranca and Santa Paula about 4.0 miles to be resurfaced with plant-mixed surfacing, and imported borrow to be placed on shoulders and bituminous surface treatment applied thereto. District VII, Route 79, Section A. Jesse S. Smith, Glendale, $24,130; J. E. Haddock Ltd., Pasadena, $29,566.25. Contract awarded to O'Brien & Bell Construction Co., Santa Ana, $22,066.

YOLO COUNTY—Between Solano County Line and two miles south of Irrigation Canal about 8.9 miles in length, shoulders to be constructed of imported borrow. District III, Route 99, Section A. Browne & Krull, Palo Alto, $24,911.50; Asta Construction Co., Rio Vista, $26,570.50; Harms Bros., Sacramento, $27,043; A. A. Edmondson and A. L. Miller, Sacramento, $28,233.50; H. & D. Construction Co., San Anselmo, $32,500; Biasotti Construction Co., Stockton, $32,707.50; Chittenden & Chittenden, Auburn, $39,080; J. Henry Harris, Berkeley, $40,087.50. Contract awarded to McGillivray Construction Co., Sacramento, $23,732.50.

CONTRA COSTA COUNTY—At Rodeo, between Sixth Street and Fourth Street, about 0.3 mile, existing pavement to be widened with asphalt concrete and shoulders to be constructed with crusher run base. District IV, Route 14, Section B. J. R. Armstrong, El Cerrito, $10,946.82; Lee J. Immel, San Pablo, $11,973; E. A. Forde, San Anselmo, $13,987; J. Henry Harris, Berkeley, $14,706. Contract awarded to Morgan Construction Co., Pleasanton, $10,874.

HUMBOLDT COUNTY—Repairing and hauling steel truss members for future use as a bridge across Redwood Creek, about 30 miles east of Eureka. District I, Route 20, Section C. Modern Iron Works, Oakland, $7,967; Moore Dry Dock Company, Oakland, $8,780. Contract awarded to Osborne Engineering Company, San Leandro, $4,820.

KERN COUNTY—Across Kern River, about six miles southwest of Bakersfield, a reinforced concrete slab bridge to be constructed. District VI, Route 575, A. R. Coffeen Co., Corona, $93,498.15; C. B. Tuttle Co., Long Beach, $105,004. Contract awarded to O. B. Pierson, Bellflower, $83,325.

LOS ANGELES COUNTY—On Hollywood Parkway, between Vineland Avenue and Barham Boulevard, about 1.8 miles to be graded and paved with Portland cement concrete and asphalt concrete, and a grade separation structure to be constructed. District VII, Route 2, Winston Bros. Co., Los Angeles, $1,427,148; J. E. Haddock, Ltd., Pasadena, $1,491,952.70; Guy F. Atkinson Co., Long Long Beach, $1,494,587.25; United Concrete Pipe Corporation & Ralph A. Bell, Baldwin Park, $1,496,189.50; James I. Barnes Construction Co., Santa Monica, $1,518,981; Morrison-Knudsen Co., Inc., Los Angeles, $1,550,731.50; Mike Radich & Co. & W. R. Shriver, Burbank, $1,564,995.75; Griffith Co., Los Angeles, $1,588,854.75; Bressi & Bevanda Constructors, Inc., Los Angeles, $1,687,355.75. Contract awarded to Peter Kiewit Sons Co., Arcadia, $1,327,527.90.

LOS ANGELES COUNTY — Between Whitaker Summit nine miles north of Castaic and Frenchman's Flat at Piru Creek, about 3.8 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 4, Section H. Morrison-Knudsen Co. Inc., Los Angeles, $1,499,817.99; Guy F. Atkinson Co., South San Francisco, $1,718,553; Bressi-Bevanda Constructors, Inc., Los Angeles, $1,724,544.50; Peter Kiewit Sons Co., Arcadia, $2,088,257.75. Contract awarded to Winston Bros., Co., Los Angeles, $1,468,303.50.

MARIN COUNTY—Across Lagunitas Creek in Samuel P. Taylor State Park, a structural steel and timber bridge to be constructed. District IV. Bos Construction Company, Oakland, $8,654.23; Butte Construction Co., San Francisco, $11,389.40; C. C. Gildersleeve, Marysville, $11,650; Litchfield Construction Company, San Rafael, $13,668; H. & D. Construction Co., San Anselmo, $14,152. Contract awarded to C. M. Allen, Fairfield, $7,996.50.

STANISLAUS COUNTY—Across Tuolumne River about 6 miles east of Modesto, a reinforced concrete girder bridge to be constructed. District X, Route 912. Dan Caputo, San Jose, $128,890; Butte Construction Co., San Francisco, $166,813; S. C. Giles & Co., Stockton, $215,333.22. Contract awarded to Erickson, Phillips and Weisberg, Oakland, $128,141.90.

Courtesy of the Road

W. E. GRIFFITH & SON

Oakland 12, Cal.

Maintenance Department
Division of Highways
Sacramento, California

Gentlemen: The writer is pleased to forward this communication to you and make comment upon an incident which occurred on March 22d, at about 7 p.m. at a point midway between Willits and Ukiah, California.

While proceeding south near the Ridgewood Ranch, a tire blew out on my automobile and being the possessor of a National Automobile Card I deemed it expedient to call their local representative and with a flash-light signaled the first car going north. The situation was explained to the gentleman driving who made the statement that it would take about half an hour to drive to Willits, possibly an hour for the garage to get started and half an hour for the garage men to appear upon the scene. He stated that he would do better than that; he would be pleased to change the tire, and the writer, being a man well along in years (and not relishing the exertion), was very glad to accept this kind offer.

When the job was completed I asked the gentleman's name, and he stated that it was Oney Harmon, and that he was employed by the State of California in the Maintenance of Roads Department.

It seems fitting that Mr. Harmon's kind action should be conveyed to his superiors. Mr. Harmon was off duty and did this kind act on his own time. I am,

Sincerely yours,

H. B. CUTTING

State of California

EARL WARREN, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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A. H. HENDERSON, Deputy Director

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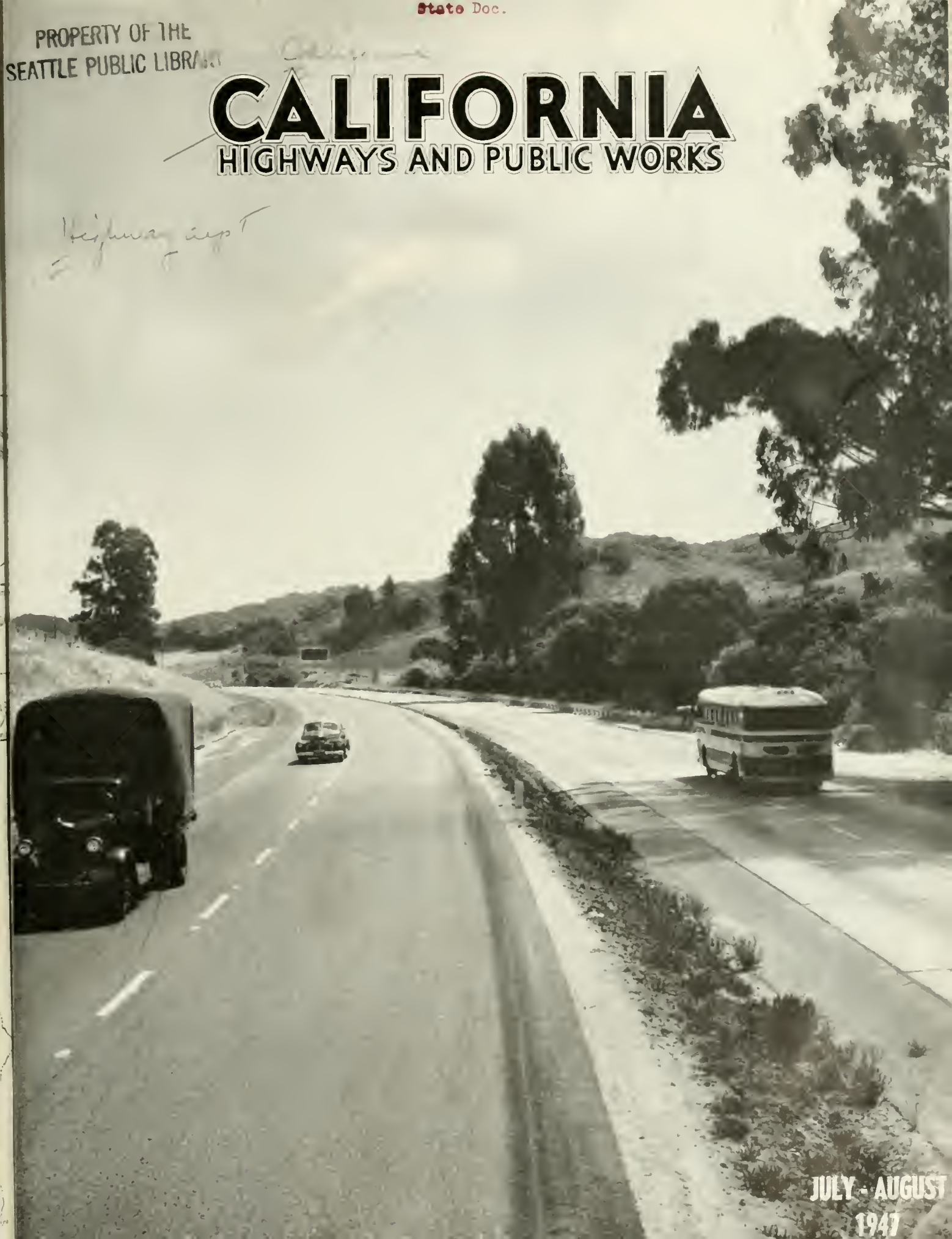
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CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



JULY - AUGUST
1947

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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Legislation Provides $76,000,000 Annually For New Construction on California State Highway System

WITH the signing by Governor Earl Warren of the Collier-Burns highway financing bill, enacted by the Legislature in the closing hours of its 1947 Session, the Division of Highways is assured of approximately $76,000,000 yearly for new state highway construction.

In addition, the cities will receive $10,000,000 more annually for use on major city streets and the counties will get the same amount for the improvement of county roads.

The Collier-Burns Act increased the gasoline tax and diesel tax by 1½ cents per gallon and provides additional revenues from an increase in registration fees and weight fees and a driver license fee.

As a result of the new legislation, the Division of Highways will be enabled to build more urgently needed multiple lane divided highways which will reduce California's excessively high traffic accident toll.

Announcing that the Division of Highways has plans and specifications for two and one-half years of highway development prepared in advance and is in a position to launch its program without delay, Governor Warren said:



Geo. T. McCoy, State Highway Engineer

"The Collier-Burns Act can be considered an important milestone in the life of our State.

"I am sure it is legislation which the people of California will welcome for it will keep our State among the most progressive and forward looking states in the Union.

"This legislation will go far toward relieving highway congestion and taking California out of the category of having the worst traffic accident record in the country.

"Our highway program is an engineering program and it must be developed along sound engineering lines. It can not be made a political program. We are not going to have any too much money to do the important highway job which confronts us."

Commenting on the Collier-Burns Act, State Highway Engineer George T. McCoy said:

"During July, the first month of the current fiscal year, there was advertised

Looking northerly toward San Francisco from Crazy Horse Summit, Monterey County, on newly completed four-lane divided highway





Governor Warren signs Collier-Burns Highway Act. From left to right, standing: Assemblyman Albert C. Wollenberg, Richard M. Zettel, Assemblyman Marvin Sherwin, Senator T. H. DeLap, Assemblymen Michael J. Burns, Thomas A. Maloney, Randolph Collier, Jr., Senator James J. McBride, Assemblyman M. Philip Davis, Senator Randolph Collier, Assemblymen Thomas M. Erwin, Thomas W. Caldecott, Senators Chris N. Jespersen, Oliver J. Carter, Thomas McCormack, President pro Tempore Harold J. Powers, Assemblymen George Miller, Jr., Stewart L. Hinckley, Senators Charles Brown, Arthur H. Breed, Jr., Assemblyman Robert C. Kirkwood, Senator Jesse M. Mayo, Assemblyman John L. E. Collier, Senators Ben Hulse and George J. Hatfield. Seated—Governor Earl Warren

for contract bid a little more than $7,000,000 of state highway construction work. This gets off to an early start an accelerated program of highway construction in California. While the full effect of the increased income for state highways will not be apparent until the next (1948-1949) fiscal year, the increased gasoline and diesel tax and the driver license fee all took effect the first of July, 1947, which will provide funds for increased construction work during the last half of the present fiscal year.

"The work which is being awarded to contract early in the fiscal year is widely distributed throughout the State. When completed it will add to California's system of multiple lane highways and will replace several currently inadequate and unsafe bridges.

ADVANCE PLANNING SPEEDED

"It has been estimated that under the provisions of the Collier-Burns Highway Act there will be available for state highway construction an average of $76,000,000 a year during the next 10 years.

"The entire act will not become operative, however, until January 1, 1948, and will not become fully effective until the next fiscal year.

"The Division of Highways has already speeded up advance highway planning that had been started shortly after the end of the war. A carefully worked out and orderly program of highway construction is being rapidly developed with the view of improving the critically congested sections of the State Highway System as rapidly as funds become available. At the same time a program of replacement of weak and inadequate bridges, as well as improvement of lateral and recreational highways, will be under way.

"California has already started upon the greatest highway construction program in its history. The improved motor transport service that will result from the construction of more and more miles of multiple lane highways, safe and adequate bridges, the improvement of highways into the State's recreational areas and providing access to untouched natural resources, and will provide spark and impetus to an ever expanding state economy."

(Continued on page 7)

Likes Our Highways

Freehold, New Jersey
June 28, 1947

Mr. C. H. Purcell, Director
Department of Public Works
Sacramento, California

Dear Mr. Purcell: I have made more than 50 trips to California; sometimes have spent more than a year there. I just returned from there. During my stay of about three months I naturally drove over many miles of your roads.

I often speak of your good roads. I would like to know more about your highways and desire to subscribe to your official journal. I may be able to help some of my friends emulate your ideas, and build and keep in repair good roads and better roads through the use by me of your Journal.

Yours very truly,
BENJ. C. WARNICK

Progress on Cabrillo Freeway

By EARL E. SORENSON, District Construction Engineer

SAN DIEGO is extremely fortunate in having, located in its geographic center, Balboa Park, 1,400 acres in area, a large portion of which is still in a semiprimitive stage.

Cabrillo Canyon and Powderhouse Canyon extend the full length of the park in a northerly and southerly direction with numerous short arroyos branching out at right angles to the mesas between. This natural terrain is peculiarly adapted to the economical construction of a freeway. The arroyos, combined with short structures for cross traffic, form a natural distribution system to all parts of the city.

The Division of Highways has had the long range planning of the completed freeway in mind for a number of years and all improvements made in the past, over the route from "A" Street to the north city limits, have been arranged to fit into the final completed improvement, which is now nearing completion.

CABRILLO ARCH BRIDGE

The only existing structure which could be utilized in the ultimate plan was the historic Cabrillo Arch Bridge on Laurel Street, built for the 1916 exposition. This bridge now forms the main cross-town artery.

The freeway project involved the construction of 15 additional bridges at the following locations: Date Street, Quince Street, Redwood Street, Upas Street, Robinson Street, University Avenue, Washington Street at Sixth, Washington Street at Tenth, Pascoe Street, Sixth Street, two structures on the Mission Valley interchange, two bridges across the San Diego River, and a bridge across Friar's Road.

The first bridge forming a part of the long range plan, was constructed across Washington Street at Sixth Street in 1940, and the final structures at the Mission Valley interchange will be completed this year.

PROGRESS HAS BEEN RAPID

Many of the salient features of these improvements, together with interesting photos showing construction oper-

Looking north across Mission Valley and showing interchange and San Diego River bed





Looking south toward Pascoe Street, Washington Street, and University Avenue bridges

ations at the start of the grading operations, were printed in the November-December, 1946, issue of California Highways and Public Works, when a discussion of the improvement of Route 77 was made by R. A. Hayler. Progress on the freeway portion since then has exceeded expectations in most phases of the work, with a few delays on special items due to shortage of labor and material. The accompanying photographs illustrate the magnitude of the work and also many of the special features.

One of these which we believe to be unique is the provision for equestrian traffic. Balboa Park Canyons and timbered hillsides form a natural setting for the bridle paths, which are used yearly by thousands of horseback riding enthusiasts. The Date Street Bridge provides a separate "fenced-in" lane for horses only. From here, the trail meanders over the hills of the West Park and again crosses the freeway over the Upas Street equestrian overpass built exclusively for equestrians and pedestrians and giving access to many miles of trails in the East Park.

The major portion of the earth moving, involving in excess of one and one-half million cubic yards was handled by tractors and scrapers. Basich Bros. employed scrapers of up to 32 yards in capacity on the northerly unit and in some cases moved earth a distance of 4,000 feet economically by this method.

Looking south from Laurel Street Bridge



Five thousand-gallon water trucks were used to supply water for compaction on the north unit, while a pipe line was used from University Avenue south. Both methods were successful and peculiarly adapted to the conditions where used. In both cases, water was introduced into the earth immediately following scarifying and prior to loading into the scrapers. This method resulted in better distribution and more uniform water content and also facilitated loading.

The installation of the sprinkling system, to water the planting from Washington Street south, is well advanced. The extent of this planting is indicated by the four-inch main supply lines which are needed to supply sufficient water to the numerous sprinklers and risers. It is anticipated that the planting will be completed and well propagated before the end of the year.

MOST STRUCTURES COMPLETED

As previously stated, the separation structures are completed with the exception of the two forming a part of the Mission Valley interchange. Scarcity of some critical materials are responsible for retarded progress, but


PACIFIC
North City Limits
LINDA VISTA
Diego
Interchange
Robinson Street
University Avenue
Richmond Street
Quince St.
Laurel Street
Sixth
Avenue
BALBOA
PARK
Boulevard
Park
U.S. NAVAL
HOSPITAL



Upper—Looking south across Mission Valley. Friars Road Bridge in foreground

Lower—Concrete paving operations through Linda Vista



it is expected that this situation will be remedied in the near future. **The location of the structures are shown in the accompanying aerial photograph.** Another photograph shows the Mission Valley interchange bridges under construction and also the progress on other phases of the work at this location.

A central mixing plant for introducing cement into selected material, to form the four-inch cement stabilized base, has been constructed on the north end of the job. The plant, consisting of crushing and screening units and a Barber Greene mixing plant, has a capacity of 100 cubic yards per hour and has already completed the mixing of the stabilized material for over 50 percent of the section north of Mission Valley.

The selected material is obtained from a highway cut at the north end of the project and is giving excellent results, showing a strength of up to 500 pounds per square inch at seven days, using 4 percent cement and 12 percent moisture. The base course is being placed using a Barber Greene spreader with the strike-off screed controlled by a wheel attachment riding the side forms. No subsequent cutting or shaping is necessary and the emulsified asphalt seal is placed directly after the rolling and compacting has been completed.

This stabilized base course is being laid on eight inches of selected material or imported borrow, forming the support for an eight-inch slab of concrete.

POURING CONCRETE SLAB

Pouring of the concrete slab is now under way and about 75 percent complete from Mission Valley to north city limits. Aggregate is being produced from Mission Valley pits and batched to the mixer through bunkers and automatic scales. Bulk cement is being used, which is placed in the aggregate at the batching plant after being weighed by electrically controlled scales.

The mixing is done on the grade by a 1½-yard Multi-Foote mixer. After depositing the concrete on the grade, it is spread by a Jaeger screw spreader, tamped by a Lakewood tamper and finished by a Johnson power float. An innovation in edge consolidation has been worked out by operating two conventional vibrators through a power take-off from the engine on the Jaeger spreader. Excellent results in densifying the concrete along the headers is being obtained. Curing is by means of an earth and water blanket.

The number of side forms required to place both stabilized base and concrete pavement in a continuous operation, in the volume planned by the contractor, was so large that it was uneconomical and impractical to obtain them. The center dividing curbs and gutters are therefore being placed prior to stabilization and paving. The subgrade shaper, cement stabilized base spreader and concrete equipment are operated with the gutter supporting and gauging the one edge. This reduces the side forms required for each lane to one line and permits the contractor to extend his operations over sufficient distance to allow the various operations to continue smoothly without overlapping or delay. This method also eliminates the objectional lateral movement or rocking of the side forms due to lateral stresses, set up by the spreader screw and also the walking beams of the finisher. This trouble is often encountered when operating on two lines of side forms.

WORK EXPEDITED

In order to expedite the work and to operate more economically on paving operations, Basich Bros. Construction Company and Mittry Bros. entered into a joint agreement for handling the stabilizing and paving operations on the two adjoining contracts and this work will be accomplished without change in equipment or crews. This arrangement will also permit a wider selection of operating areas so that pavement can be placed, without intervening shut-downs, at locations as rapidly as they become available. Rapid progress is anticipated with an average production of 650 cubic yards of concrete per shift.

The intimate and overlapping nature of the construction operations on this series of projects and the fact that as many as six separate contracts have been carried on simultaneously have made necessary careful correlation of the work and very close cooperation between contractors. In view of this condition, as well as difficulties in securing materials and labor, the progress to date has been very gratifying and no appreciable overruns in the various completion dates are anticipated.

$76,000,000 Annually For New Construction On State Highways

(Continued from page 2)

The Collier-Burns Highway Act incorporated many of the major features of the original Senate Bill No. 5 introduced by Senator Collier as a result of the report made by the Joint Fact Finding Committee on Highways, Streets and Bridges, following a two-year study as a legislative interim body.

The new law, like Senate Bill No. 5, establishes a primary system of county roads in each county, limited to not more than 50 percent of the total mileage of county roads, and designates the balance of county roads as "the secondary road system" in each county. It also requires each county to consolidate its road administration under a single road administrator, who must be a registered civil engineer or a person approved as qualified and competent by the board of supervisors. No allocation or payment of highway funds may be made to a county until such consolidation has been accomplished.

The new law also clarifies a system of major city streets in each city to consist of those streets of greatest general city importance, and places those city streets not included in the major city street system in the secondary city street system.

Proper accounting, reports and audits are required from both county and city authorities in the expenditure of highway funds allocated to them by the act.

Also retained from Senate Bill No. 5 is the feature creating the Highway Users Tax Fund, to which all highway revenues, after deducting administrative costs, will be assigned. Allocations from the Highway Users Tax Fund to cities, counties and the State will be made in accordance with a definite formula, embodied in the measure.

From the gasoline tax revenues, cities and counties, under this formula, will receive sums equivalent to the return from 2 cents of the state tax of

(Continued on page 26)



Near its southern end, where it joins El Camino Real at Ford Road seven miles south of San Jose's central business district, the New Bayshore Freeway Extension crosses Coyote Creek on a center-tiered span and then, at the far left, bridges Coyote Road

New Link of Bayshore Highway Through San Jose Is Officially Opened to Traffic

MEMBERS of the California Highway Commission joined with officials of Santa Clara County and of the City of San Jose in dedicatory ceremonies marking the opening to traffic on June 19th of the newly-completed eight-mile extension of the Bayshore Highway through East San Jose.

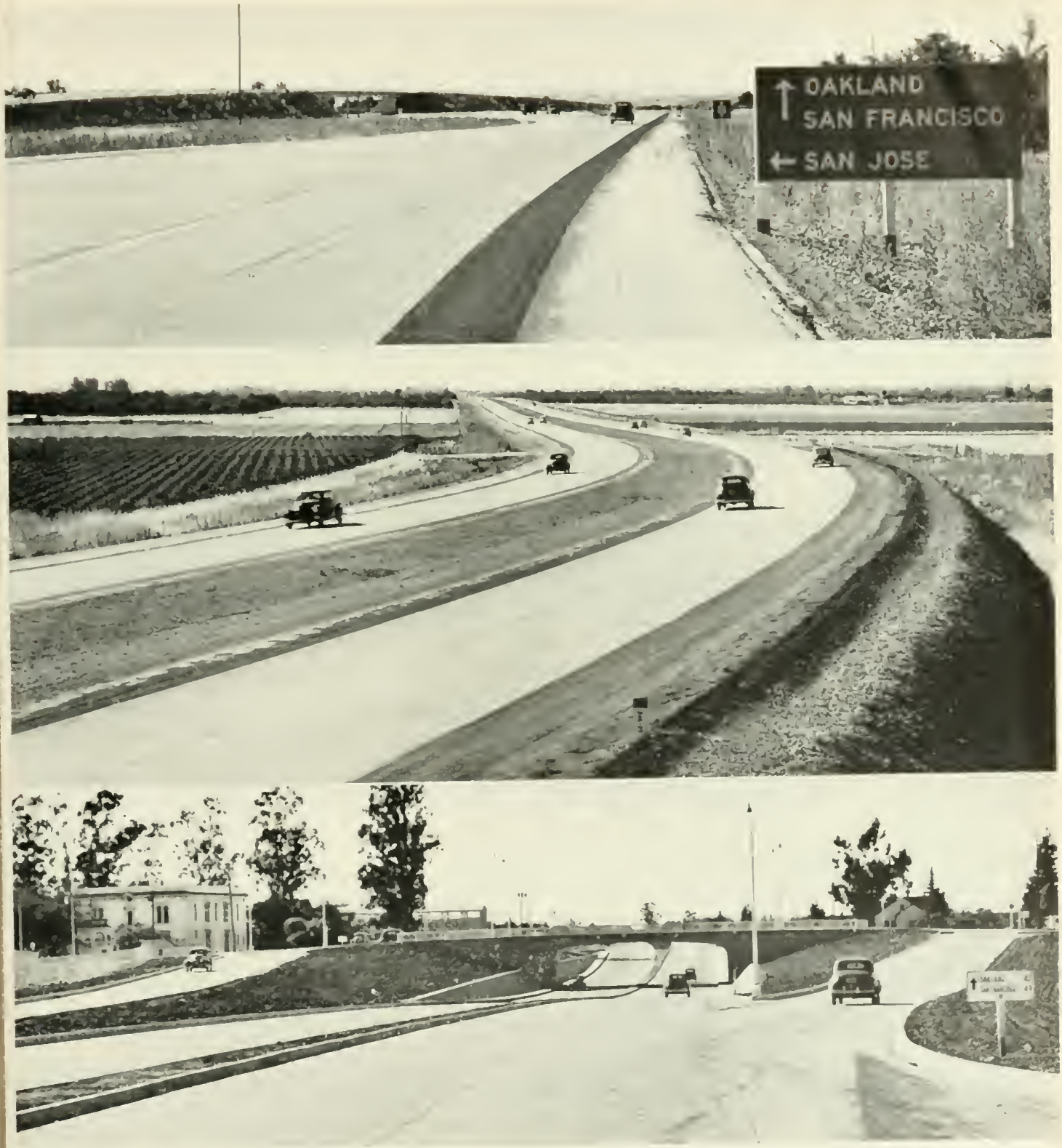
Constructed at a cost of $2,865,000, the new highway extends from East Santa Clara Street to Monterey Highway at Ford Road. It will relieve traffic congestion in the downtown section of San Jose.

Representing C. H. Purcell, Director of Public Works and Chairman of the Highway Commission, Harrison R. Baker, Commissioner from Pasadena, hailed the project as an important milestone in the State's postwar highway program.

"This highway," he said, "is part of an overall plan that will link San Jose to Oakland and San Francisco by two great Freeways—the Bayshore and Eastshore Highways."

The new road is a four-lane highway with a 36-foot dividing strip. Provisions have been made to eventually widen the highway to six or eight lanes.

Russell E. Pettit, manager of the San Jose Chamber of Commerce, was master of ceremonies at the highway opening. Taking part in the program were: E. O. Wool, chairman of the Santa Clara County Board of Supervisors; Frank M. Shay, chairman of the Central Coast Council, California State Chamber of Commerce; Edward V. McIntosh, president of the San Jose Chamber of Commerce, and Mayor Albert J. Ruffo participated.



Upper—Northbound motorists approaching San Jose must enter the Ford Road Interchange at the southern terminus of the new Bayshore Freeway Extension, where it joins El Camino Real. Here they have the alternative of turning left, under the overhead structure, toward the business district of San Jose, or proceeding straight ahead along the freeway extension, which passes through the outskirts of San Jose on the way to San Francisco or Oakland. Center—Approximately midway in the new Bayshore Freeway Extension, passing through the outskirts of San Jose to connect Bayshore Highway with El Camino Real south of the city, is this gentle, 3,000-foot radius curve. Lower—Near its northern terminus the new Bayshore Freeway Extension, skirting San Jose in connecting Bayshore Highway with El Camino Real to the south of the city, passes through the Santa Clara Avenue interchange structure. In this view, looking north, the freeway leads straight ahead to San Francisco and Oakland, while the road to the right joins Santa Clara Avenue leading west to San Jose's business district or east to Alum Rock Park

Portion of Bayshore Freeway Expected To Be Completed Early Next Year

By H. A. SIMARD, Associate Highway Engineer

THE GRADING and paving of a five-mile portion of the Bayshore Freeway between South San Francisco and Broadway Avenue in Burlingame, one of the largest single contracts ever let by the Division of Highways, amounting to $3,250,000, is progressing at a rapid rate with completion early next year being assured.

This project was originally planned as an expansion of the existing four-lane undivided Bayshore Highway. However, the City of San Francisco had under execution a $20,000,000 expansion program for its airport, Mills Field. After considerable negotiation between the city and the State, the present route for the freeway to the west of the present road was adopted. This allows an additional 2,600 feet westward for the expansion of the airport.

This freeway is being constructed as a six-lane divided highway. The division strip, 36 feet in width, is sufficiently wide to provide for two additional traffic lanes when traffic conditions justify. The pavement to be placed under this contract consists of two separate roadways 36 feet in width surfaced with four inches of asphalt concrete on eight inches of crusher run base.

MUD DEPTHS OVERCOME

In general, the project traverses reclaimed marsh and tidelands which have for a number of years been used for cattle grazing and the growing of hay crops. Underlying these reclaimed lands are mud depths varying from 0 to 60 feet so that throughout most of the project very unstable foundation conditions are encountered. Embankments for the new highway have an average height of seven feet. In order to accelerate the anticipated settlement of these embankments throughout the unstable areas, an overload of two feet above profile grade is being placed. This overload is removed after a minimum waiting period of 30 days in order that the subgrade can be prepared for the pavement.

In some of the deeper mud areas and at the approaches to proposed traffic interchange structures, the foundations for which are now being constructed under a separate contract, the sand drain method for consolidation of the underlying mud is being

Here a five-yard truck is spreading sand blanket over sand drains





Fan sprays on 4,500-gallon water truck mounted on Euclid truck unit in operation

used. In other structure locations or approaches where the mud depths are less than 20 feet the mud is being stripped before the placement of embankment material. Where no foundation treatment is being used the embankments are placed on the original ground at a slow rate so that it will consolidate without being displaced.

SAND DRAINS NECESSARY

The sand drains referred to in the above paragraph consist of a vertical hole 18 inches in diameter extending to relatively firm bottom and backfilled with a carefully graded sand. Firm bottom is generally defined as material having a moisture content of 25 percent or less. The drains, placed on 10-foot centers in order that there is a drain for each 100 square feet of fill area, are expected to provide a means of relief for the subsurface water as the fill loads are increased, thus permitting consolidation of the mud during construction; a consolidation which normally would continue after completion.

The total estimated quantity of vertical drains to be constructed is 235,000 lineal feet, with the depths ranging from a minimum of 15 feet to a maximum of 60 feet in the deepest marsh areas.

The method of installation on this project consists of driving an 18-inch diameter mandrel equipped with a bottom plate to the required depth and introducing the sand backfill by means of a hopper at the top. Air under pressure of 100 p.s.i. is then admitted at the top and as the mandrel is withdrawn, the backfill material is forced past the free hanging bottom plate and into the hole.

Pile driving rig for constructing sand drains



DRIVING OF MANDREL

Driving of the mandrel is accomplished by means of a crawler-mounted 2½ yard Lima crane, with six feet extra length added to the crawler tracks to take care of counterbalance, equipped with 80-foot leads and an air-driven hammer. Prior to placing sand drains, it was necessary to place a "working table" of selected material to a thickness of from 2 to 3 feet over the marshes in order to provide support for this equipment. Nevertheless, it was still necessary to use heavy timber mats under the rig in the deeper mud area at the northern end of the project.

After the completion of sand drains in each area treated, the next order of work is the placing of a 12-inch layer

of sand fill material over the entire width of fill at the tops of the vertical drains. The purpose of this blanket is to provide a means of release for the subsurface water brought up through the vertical drains. Embankments were constructed by placing subsequent lifts of selected material on the sand blanket.

The maximum rate of embankment construction was limited by specifications to one foot per day and three feet during any one week. The actual rate of loading in the areas treated with sand drains was determined through observations of results obtained by means of settlement platforms and pore pressure installations.

MARSH LAND PROBLEMS

The settlement platforms, 3 feet x 4 feet x 3 inch dimensions, were placed on the original marsh prior to the start of construction. A section of iron pipe was attached to each platform with the top of the pipe kept above the top of the fill by the addition of lengths as the fill heights were increased. The rate of settlement and total consolidation are readily obtained by means of elevations taken on the tops of the pipes. Permanent installations are planned which will permit future observations after completion of the project.

Hydrostatic pressures developed at various depths in the marsh areas underlying the embankments are observed by means of equipment designed and provided by the Materials and Research Department.

Briefly, these pressure measuring installations consist of well points driven to the desired depths and connected to compound gauges outside the toe of the fill by means of iron pipe and copper tubing.

Pressures as high as 10 p.s.i. are developed during loading of the embankments, gradually decreasing to normal as the subsurface water is released through the sand drains and drainage blanket.

MATERIAL IMPORTED

By correlating the rate of consolidation, as determined from the settlement platforms, with the pressures developed at the well points, the rate of application of additional lifts is determined, with the result that excessive pressures (and consequent later displacement or failure) should be avoided.

Since the area traversed by this freeway construction is marshy with no material within the limits of the right of way available for the embankment construction, it is necessary to import material for this purpose. At the time the preliminary report and special provisions for the contract were being written, Macco Corporation & Morrison-Knudsen Company, Inc., were hauling material to expand Mills Field Airport from a borrow pit approximately three miles west of the center of the proposed project over a private haul road which crosses El Camino Real, Southern Pacific Railroad and Bayshore Highway on overhead structures. This material deposited on Mills Field was being paid for by the cubic yard from cross-section measurements of the borrow pit.

50,000 TONS OF BORROW PER DAY

It appeared likely that this same construction company would submit a favorable bid for this freeway construction since it was sitting astride the project with materials and equipment at hand to do the job. It was, therefore, decided to pay by the ton for the approximate 2,000,000 cubic yards of borrow required in order to accurately segregate the material going to two jobs from the same source. The maximum amount of borrow hauled in any one 18-hour day was 50,000 tons.

This amount of material was hauled in large dirt moving units composed of Euclids netting 22 tons, Dixon wagons netting 25 tons and Peterbilts netting 47 tons. These dirt moving units are loaded at the borrow pit with 2½ cubic yard Northwest diesel and 6 cubic yard Bucyrus Erie electric shovels. Rooters are used at the pit to loosen the material, then it is pushed to the shovels with D8 Caterpillar tractors equipped with bull dozers. The maximum number of equipment units used at any one time was 35 Euclids, 18 Dixon wagons and 25 Peterbilts which were being loaded with three 6 cubic yard electric and two 2½ cubic yard diesel shovels.

MOUNTAIN IS REMOVED

It is interesting to note that although the borrow pit from which this material is being obtained was once a mountain, it is now a vast hole in the ground after the removal of some 12,500,000 cubic yards of borrow, some 10,000,000 cubic yards having been delivered to the San Francisco Airport at Mills Field. However, all excavations are made to an approved contour plan and about 243 acres of very valuable land will be made in a location formerly used only for grazing.

There are a number of large drainage structures on the project, the largest of which are being constructed as part of the proposed drainage system planned by the City of San Francisco to keep drainage waters away from the airport. A canal to collect these drainage waters is proposed all along the western side of the freeway between San Bruno Avenue and Millbrae Avenue, a distance of 2½ miles. At the northerly end this canal system crosses under the freeway through a triple 10 foot x 8 foot x 181 inch reinforced concrete culvert and through a triple 10 foot x 8 foot x 500 inch reinforced concrete culvert under the San Bruno Avenue cloverleaf ramps. At the southerly end the canal crosses under the freeway through a triple 10 foot x 6 foot x 155 inch reinforced concrete culvert.

There are also two large reinforced concrete boxes, 7 feet x 6 feet x 166½ inches, being constructed to carry utilities under the freeway to the airport.

The project is being constructed under the supervision of Jno. H. Skeggs, District Engineer; R. P. Duffy, District Construction Engineer; and H. A. Simard, Resident Engineer, representing the State Division of Highways.

Macco Corporation & Morrison-Knudsen Company, Inc., are the Contractors on this $3,250,000 contract and are represented on the job by O. H. Tucker, Project Manager, and George Haensel, General Superintendent.

A separate Bridge Department contract is now under way for the foundations on the interchange structures at Broadway Burlingame, Millbrae Road, the San Francisco Airport connection and San Bruno Avenue. Carrico & Gautier are the contractors on this project.

The superstructures for these separations will be let to contract as soon as the critical steel shortage has eased.

On opposite page. Upper—This 30-cubic yard Peter truck is spreading imported borrow. Center—Electric shovel dipper loading 19-cubic yard Dixon wagons at borrow pit. Lower—Three section sheep foot tamper compacting fill


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Improvement on Trinity Lateral Is Under Way Through Rugged Mountain Terrain

By GEORGE F. HELLESOE, District Engineer

U. S. ROUTE 299, commonly referred to as the Trinity Lateral, connects with U. S. Route 101 near Arcata, and after crossing and traversing the low, though rugged coastal mountains easterly for a distance of 37 miles, enters the Trinity River Valley at Willow Creek. After leaving the comparatively small valley, it follows the precipitous canyon of the Trinity River to Junction City and then over the mountain into Weaverville and on to a connection with the Pacific Highway at Redding.

In general, this state highway follows the route of the early pack trails used in the gold rush days. These trails were established through information obtained by early explorers in search for the easiest route between the placer mines on the upper Trinity River and the coast. That this important transmountain route occupies the approximate location laid out by early trail blazers, is recognition of their adeptness in selecting the most feasible route through a then unexplored wilderness.

A portion of the present route, following the more rugged Trinity Canyon, was constructed by the Public Roads Administration in 1919. Connecting links were then constructed by the State and Humboldt County in 1924 to complete a through road, many portions of which are used to this day.

Upon completion of reconstruction of that portion between Weaverville and Prairie Creek in 1942 by the State, forces assigned to that work were transferred to District 1 and from a camp established near Burnt Ranch, work was started on constructing a standard road in the very rugged part of the canyon between Cedar Flat and Salyer.

In moving equipment to the new site of Camp 36, it was first necessary to move 100,000 cubic yards of excavation in widening various narrow portions of highway in order to transport the power shovel to the new work. While this work consisted merely of widening into the cut banks, it has provided a wider and safer roadbed for traffic use until such a time as the schedule permits its reconstruction to adequate standards. During the period of this widening, clearing and culvert construction preparatory to grading operations were started and carried on from Burnt Ranch, westerly.

During July, 1943, because of the uncertainty of continuing operations due to interference with the war effort, additional tractor and carry-all equipment was assigned to grading operations. This additional equipment permitted completion in September, 1943, of a section of narrow and tortuous road 1.12 miles in length between two minor sections of road previously improved under contract.

Because of the strategic military value of U. S. 299, authority was obtained during the latter part of 1943 to accelerate construction operations which had been dormant since September. Grading the narrow bluff sections easterly from Burnt Ranch to Cedar Flat was then undertaken. Grading of this 2.7 mile section of highway was completed during April of 1945.

In constructing this section, the new highway crossed the locally known China slide area. This slide, occurring in the late eighties, was the largest recent landslide in this section of California and its scars are still readily seen from the new highway. The slide is attributed to exceptionally heavy rainfall, combined with erosion of the banks of the Trinity. The immediate result of the slide was to dam the rising waters of the river, impounding an extensive lake some hundred feet in depth. Subsequently, upon failure of the dam, caused by the slide material, very high waters occurred in the lower Klamath to which river the Trinity is tributary.

It is told that Chinese miners, who flocked to this region after the white miners had removed the cream of Placer gold, saw a golden opportunity when the river was obstructed by the slide to mine the bed of the stream below. This they proceeded to do but failed to heed the danger of the rising waters above. When the obstruction was crested by the rising waters, causing disintegration of the slide dam, the unfortunate Chinese could not escape the immense rush of water. How many lives were lost is unknown, but ever since this catastrophe occurred this landmark of early day mining in California has been known as China Slide.

COMPLETION DATE NEXT YEAR

Since the summer of 1945 grading operations, except for one winter's work east of Cedar Flat, have been concentrated on providing a graded and oiled road from Burnt Ranch to Salyer, a distance of about 12 miles. This objective is now nearing realization and by the fall of 1948 it will have been completed.

The reconstruction of this portion of highway has been complicated by the necessity of excavating a bench section 26 feet in width across four rugged bluff sections now traversed by the existing one-way road. These bluff sections are steep and wet and though cursory inspection of their slopes indicates rock, this, upon proper investigation has been found to be shale and other unstable material.

Larger slides have consequently occurred which have made imperative the opening of a detour for traffic to by-pass the slide areas. The detour, known locally as the Hennessey Road, was constructed jointly by the county and state forces in 1945 and by-passes the highway from Salyer to Burnt Ranch. During the current grading season, it has been in use for only one day to provide uninterrupted travel on U. S. 299 for the convenience of the public.

Throughout the project rubble masonry retaining walls have been utilized, wherever economically justified, to secure the designed width of roadbed without undue disturbance of the unstable hillside or bluffs. These retaining walls of native stone blend well with the surrounding landscape and provide occassional vista points from which the rugged Trinity River canyon and the winding stream hundreds of feet directly below can be safely viewed.

(Continued on page 16)



Upper left—Rough grading is nearing completion on this rocky section of the Trinity River highway east of Cedar Flat, where much drilling and blasting is necessary. Lower left—Improvement of U. S. 299 across Gray's Bluff is about complete, except for oiling. Upper right—This winding, narrow section of U. S. 299 along Trinity River, near Salyer, is scheduled for early realignment and widening. Lower right—Steep, rocky bluffs are encountered in grading operations along much of the Trinity River Route

Appreciation

Tahoe Vista, California
Department of Public Works,
Division of Highways,
Marysville, California

Gentlemen: The large cedar tree, about 102 feet in height, located on the highway right of way in the Agate Bay Subdivision at Tahoe Vista, California, was removed a few weeks ago by your crew.

I want to commend very highly the work of Mr. A. J. Bellue who superintended the removal of the tree, as the work was done in an extraordinarily expert manner. The tree was enormous and was one which, if it had not been properly felled, would have caused considerable damage by falling over the highway or into the property here. Under the guidance of Mr. Bellue and with his excellent knowledge of his work, he and his crew felled the tree so that it fell just where they had intended it to fall.

A like tree fell across the highway up at Kings Beach, killing a man and perhaps injuring his wife and baby.

We appreciate very much the way this job was handled.

Very truly yours,

JAMES LAKESHORE
RESORT
T. L. James

TRINITY LATERAL IS UNDER WAY

(Continued from page 14)

Arch culverts and other appurtenant drainage structures have been constructed of rubble masonry and since operations started in 1942 there have been constructed over 9,000 cubic yards of masonry. Roadway excavation quantities involved in constructing approximately 10 miles of graded road now exceed 1,000,000 cubic yards. Considering the terrain traversed, the average grading quantities per mile of 100,000 cubic yards is considered very reasonable.

R. C. McFarland is superintendent of construction and H. O. Ragan is Resident Engineer with the work being supervised by Charles P. Sweet, District Construction Engineer. The work is located in the Eureka District of the Division of Highways.

Visitors to State Fair Will Travel to Capital Over New Four-Lane Highways

VISITORS to the California State Fair to be held in Sacramento August 28th through September 7th will get a preview of the kind of highways that will one day be commonplace in California now that the Collier-Burns Highway Act is a reality.

Nearest to the capital and one of the foremost projects in the Division of Highways' postwar construction program is the North Sacramento Freeway, which is scheduled to be completed by September 1st.

This $1,800,000 project will provide a new route for U. S. Highway 40-99E around the City of North Sacramento in place of the old road that passed through block after block of the business district. The freeway, a four-lane divided highway, contains eight grade separation structures to insure complete freedom from all conflicting traffic.

NEW FOUR-LANE HIGHWAYS

A phenomenon peculiar to these divided highways is the way that heavy traffic on adjacent two-lane sections literally vanishes a few moments after reaching the divided sections. Visitors to the fair from the Bay area traveling via U. S. Highway 40 will enjoy this experience upon reaching Vacaville, for two contracts recently completed at a combined cost of $1,600,000 have extended the four-lane divided highway leading into Sacramento 12 miles westerly.

For six of the 12 miles the old pavement has been retained for the two west-bound lanes, but the other six miles are on new direct alignment that abandons the old dog-leg into Dixon.

All roads will lead to Sacramento during the fair, and motorists from the south will get several glimpses of highway improvements under way on whichever route they choose. Most of the southern visitors will converge on Stockton for the last lap to the capital, to ride upon another recently completed divided highway, the eight-mile, $800,000 four-lane section of U. S. 50-99 from the Calaveras River to Lodi. Probably none, however, will appreciate this particular improvement so much as local residents who for many years had to contend with the woefully inadequate two-lane road.

U. S. 50 IMPROVED

Consistent with the policy of the Division of Highways, the old road has been retained as half of the divided highway. And lest the bottleneck through Stockton be too fresh in mind to enjoy this new section, plans are being prepared for a cut-off from the Calaveras River to Mariposa Road south of Stockton which will avoid the city entirely.

Fair bound travelers coming into Sacramento from Placerville will ride on a new 3.4 mile section of U. S. Highway 50 between El Dorado and Shingle Springs recently completed at a cost of $272,000. The new road through the rolling foothill country, built entirely on revised alignment, is 0.4 mile shorter than the old.

By way of contrasting highway standards of yesterday and today, the old road, built in 1915 to standards adequate for that time, had 35 curves with central angles totaling 1,020 degrees and some radii as sharp as 100 feet. The new road, on the other hand, has only six curves with central angles totaling 142 degrees and a minimum radius of 1,500 feet.

U. S. 40 PROGRAM

It is not certain at this time whether the new limited access highway for U.S.40 through Auburn will be opened to traffic by fair time. If it is, motorists will hardly recognize the town, for the new road avoids entirely the tortuous, steep and narrow route that leads through the business district.

The new highway consists of 2.6 miles of four-lane divided highway with a six-foot dividing strip. The entire project, including two street and one railroad grade separation structures built under separate contracts, will cost approximately $825,000.

Reconstruction of 3.6 miles of the Auburn-Grass Valley Road now under way in and adjacent to Auburn will complete the modernization of state highways in that city. This portion of Route 17, also to be a limited access highway, will be completed about November 1st.


Welcome to the
CALIFORNIA
STATE FAIR
SACRAMENTO
Via the
World's Finest
Highways
SAN FRANCISCO
OAKLAND
SAN JOSE
SALINAS
STOCKTON
MODESTO
MERCED
FRESNO
SANTA BARBARA
BAKERSFIELD
LOS ANGELES
LONG BEACH
RIVERSIDE
SAN BERNARDINO
BARSTOW
BISHOP
SAN DIEGO
EL CENTRO
BLYTHE

Two-Way Mobile Radio System Installed On San Francisco-Oakland Bay Bridge

By H. C. SNEAD, Associate Electrical Engineer

ONE HUNDRED eighty-six thousand miles a second! Such is the speed with which messages are now dispatched to emergency service equipment on the world's busiest toll structure—the San Francisco-Oakland Bay Bridge.

Stretching out over land and water a distance of six miles from Fifth Street in San Francisco to the Toll Plaza in Oakland, it is, because of its very nature, without parking facilities. Hence, stalled vehicles must of necessity occupy a lane of the traveled way, offering an obstruction to the free flow of traffic.

With present traffic densities on the upper deck of 7,000 vehicles per hour during peak periods (4,200 one way in three lanes), vehicles accumulate behind a road obstruction with great rapidity. A stoppage of only a few minutes may, in adverse circumstances, result in congestion which will require a half hour or more to clear. The need of removing stalled cars without any delay is, therefore, of primary importance to the smooth and rapid mass movement of traffic.

Faced with the necessity of maintaining the orderly flow of traffic, which averages 70,000 cars per day and which, on June 20th last, reached a peak of 92,614, the Division of Highways turned to high frequency radio as a means of reducing to a minimum the delays in removing obstructions to traffic. With the equipment installed, tow cars or service vehicles enroute to or from a stalled car may now be redirected while moving, as the need arises. The necessity of returning to their station, or calling in from widely-spaced bridge telephones for assignment no longer exists.

The former practice of telephone communication from the bridge deck in itself created an obstruction to the free flow of traffic and, at best, did not provide the close control of emergency vehicles necessitated by the changing situations arising during the peak hours of travel. The dispatcher may now sit at his microphone with a chart before him showing the position of all of his equipment at any instant and direct the various units, by radio, with the greatest efficiency.



"Coming in with stalled car," radios tow truck operator on San Francisco side of San Francisco-Oakland Bay Bridge. Seconds count on this 6 mile long bridge where a car breakdown can seriously hinder traffic which averages 70,000 vehicles per day. A mobile two-way FM radiotelephone in the truck permits instant communication with the dispatcher

An average day will find 35 cars stalled on the bridge requiring emergency service for various causes, but this figure has, on occasions, reached 80. In addition, emergency service vehicles render "standby" service to many other disabled vehicles. This service may consist of a push to get started, disentangling hooked bumpers, providing protection while a motorist changes his own tire, or the like.

While standby services may not appear in the records as an emergency roadside service, they require the dispatching and use of a piece of emergency equipment.

To cope with this condition, four state-owned tow cars are kept in constant readiness. During peak hours these are supplemented by four pickup trucks equipped to render most emergency roadside services, such as changing tires, supplying gasoline, and extinguishing fires; that is, all except actual towing operations. These, together with the electricians' truck, the fire engine, the fire chief's pickup, and the traffic engineer's sedan constitute the "radio" fleet.



Bay Bridge tow truck, showing radio cabinet mounted on running board

RADIO EQUIPMENT INSTALLED

Designed to operate in the 156 megacycle band, the radio equipment is frequency modulated. The equipment installed was manufactured by Motorola and was purchased under competitive bids on specifications prepared by the State. Installation of both fixed and mobile equipment was performed by the radio technicians of the California Highway Patrol and the electrician force of the San Francisco-Oakland Bay Bridge.

Assigned KKJW as call letters by the Federal Communications Commission, transmitters are licensed for 60 watts maximum input. Two separate frequencies are used for the fixed, or main, station and the mobile units. The main station transmits on 156.45 MC., and the mobile units transmit on 156.69 MC. With such an arrangement, communication between mobile units is not possible except through the main station operated by the dispatcher who thus maintains control of the movement of all equipment at all times.

Two-way radiotelephone under rugged conditions. Lower deck of San Francisco-Oakland Bay Bridge showing electric interurban train and radio-equipped tow truck emerging at east end of bridge. High frequency 160,000 kilocycle FM two-way radiotelephone equipment permits 100 percent radio coverage regardless of electrical interference or steel-enclosing structure



RANGE OF 20 MILES

Being in the very high frequency (VHF) classification, the radio system is in the "sight line" group and has a range of about 20 miles. Its effectiveness in penetrating normally inaccessible locations within this range, however, was demonstrated by tests prior to the purchase of the equipment. Radio waves of the frequency employed travel in a straight line but are redirected or reflected from solid objects such as building walls and cliffs. In fact, they may bounce several times before their useful strength is dissipated. As a consequence, the equipment installed successfully penetrates the entire length of the lower deck of the Yerba Buena Island vehicular tunnel, a feat not duplicated with lower frequencies.

Special cabinets were designed and installed for housing the radio apparatus on the tow trucks and the pickup trucks used in the emergency service.

SPECIAL CABINETS

In vehicles of these types, sufficient enclosed space for this purpose, such as is found in the luggage compartments of passenger vehicles, is not available. The cabinets were designed for quick and easy access. Covers are held in place by springs and catches

(Continued on page 26)

Red Rock Bridge Becomes Interstate Link on U.S. 66

By R. ROBINSON ROWE, Senior Bridge Engineer

WHEN the historic Red Rock Bridge was opened to highway traffic in June, a striking improvement was made in the interstate connection on U. S. 66 over the Colorado River near Topock, Arizona. Not only was the last posted bridge eliminated from California's part of this transcontinental route, but relocation of the approach permitted abandonment of its narrowest and crookedest stretch.

The degree of improvement will be evident from the following statistical summary for the entire relocation:

Highway Item	Before	After	Gain
Distance, miles	3.04	2.62	0.42
Curvature, degrees	1070	437	633
Ascent and descent, feet	710	110	600
Sharpest curve, degree	54	14	40
Bridge width, feet	17.0	19.0	2.0
Load limit, tons	11	All legal loads	

STATES SHARE COST

The cost of this improvement was $147,000, of which $71,500 was spent for replacing the rail deck of Red Rock Bridge with a concrete highway deck; $70,500 was the cost of widening and surfacing two miles of railroad grade for the California approach and $5,000 was used to grade and pave the connection in Topock. Each state built its own approach and the two states divided equally the cost of bridge reconstruction.

The opportunity for this low-cost improvement was presented April 20, 1942, when the Atchison, Topeka and Santa Fe Railway Company obtained federal approval of its project to build a new bridge cross the Colorado River 500 feet upstream from Red Rock Bridge, in order to straighten and double-track its line for streamliners and heavy freight traffic. A suggestion that the Red Rock Bridge be acquired by the states was answered by the obligation of Santa Fe to dismantle it within 90 days after its new bridge was completed, raze channel piers to river bed and turn the old steel in for scrap, which was then in desperate demand. Although Santa Fe expressed a willingness to donate the bridge to avoid the cost of demolition, this obligation to contribute to the Nation's scrap pile stopped the preliminary negotiations.

ARMY INTERESTED

Meanwhile the Army had been blocked in desert training maneuvers by the 11-ton limit on the highway bridge. It had sought permission to move heavier tanks and artillery across this slender arch, but the maximum permissible one-way passage one vehicle at a time was too restrictive for the military purpose. The Army became interested in the idea of converting Red Rock Bridge, which reopened the question of the scrap-steel obligation. A survey showed that scarcity of scrap would probably end before the old bridge could be contributed.

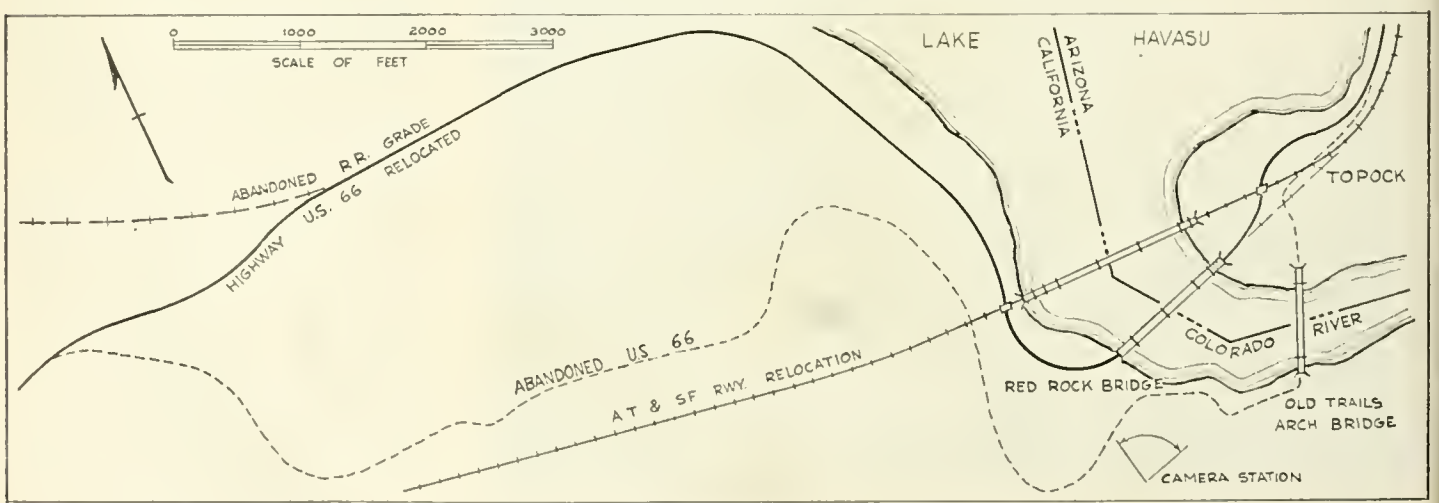
Negotiations were reopened and the railroad renewed its offer, with the addition of approach right of way over 1.5 miles of old railroad grade. The states accepted in a three-party agreement covering division of costs of reconstruction and maintenance, which was finally executed March 10, 1944. The year or so remaining before Santa Fe could release the old structure was spent in clearing up several legal points, which arose from the interesting history of bridges over the Colorado in this vicinity.

HISTORY STARTED IN 1866

Immediately after the Civil War railroad promoters started a race for a transcontinental line along the Thirty-fifth Parallel. The race ended August 13, 1883, on the Arizona bank of the Colorado River eight miles northwest of Topock when the Southern Pacific, pushing east, bridged the Colorado to connect with the Atlantic and Pacific Railroad Company. This bridge was destroyed May 4, 1884, and replaced by A. & P., which had leased Southern Pacific's line to Barstow.

This second bridge was soon threatened by the meandering Colorado River and A. & P. spent large sums to maintain it, including tribute of $500 per month to a steamboat company

Relocation of U. S. 66 via Red Rock Bridge and the old railroad grade





The last train crossing Red Rock Bridge (center span) March 8, 1945, after new Santa Fe Bridge (left background) was completed. U. S. 66 crossing the river on the Old Trails Arch (far right) has since been relocated via Red Rock Bridge

when the main channel was diverted away from the draw span. For some time A. & P. had been operated jointly by the Atchison, Topeka and Santa Fe Railroad Company and the St. Louis and San Francisco Railroad Company after a foreclosure sale.

ACT OF CONGRESS

Under the Act of Congress of July 27, 1866 (14 Stat. 292, Chap. 278), authorizing the original location, these new owners built the Red Rock Cantilever Bridge at Topock. This site had also been selected in 1867 by the Kansas Pacific Railroad locators and foundations had been explored by borings in 1880, but this other company had abandoned its line.

This third railroad bridge was completed June 25, 1890. However, the second bridge had washed out on May 9th, the day after the suspended span of the new bridge was pinned and swung. In a few hours the traveler engine was removed, track was laid through the legs of the traveler and trains were routed over the bridge without ceremony.

LEGAL QUESTIONS

The rights of the succeeding railroad companies to the bridge site derived from the authorization of the Act of 1866 "to lay out, locate, and construct, furnish, maintain and enjoy, a continuous railroad and telegraph line with appurtenances" from a point in Missouri to the Pacific, including a crossing of the Colorado River "at such point as may be selected by said company for crossing." Having no rights, for highway facilities, none could be conveyed to the states.

This was cured in part by the amended Federal Highway Act (42 Stat. 212), authorizing railroads "to convey to the highway department of any state any part of its right of way or other property in that state acquired by grant from the United States," and the Act of May 5, 1920 (41 Stat. 621), which eliminated the restriction to federal aid highways. Thus the railroad was within its rights in conveying physical property to the states, but it was not clear that the states had ac-

Old construction photo of Red Rock Cantilever Bridge nearing completion in 1890



quired thereby the right to maintain a *highway* bridge over a navigable interstate stream.

FEDERAL CONSENT OBTAINED

To avoid any question, federal consent was requested, and granted in December, 1944, by the following Act of Congress (Public Law 537, Chapter 688, Seventy-eighth Congress, Second Session):

"An act authorizing the Atchison, Topeka and Santa Fe Railway Company, or its successors, to convey to the states of Arizona and California, jointly or separately, for public highway purposes, an existing railroad bridge across the Colorado River, formerly known as the Red Rock Bridge, near Topock, Arizona.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that, in order to facilitate interstate commerce, improve the postal service, and provide for military and other purposes, the Atchison, Topeka and Santa Fe Railway Company, or its successors, is hereby authorized to convey to the States of Arizona and California, jointly or separately, the existing railroad bridge and approaches thereto, across the Colorado River, formerly known as the Red Rock Bridge, located near Topock, Arizona, which bridge has been or will be superseded by realignment of a portion of the Atchison, Topeka and Santa Fe Railroad and construction upstream from said existing bridge of a new railroad bridge.

"Sec. 2. The states of Arizona and California, jointly or separately, are hereby authorized to accept title to, and thereafter to construct, reconstruct, maintain and operate said bridge, as a free highway bridge, and approaches thereto in accordance with the provisions of the act entitled, 'An act to regulate the construction of bridges over navigable waters'."



California portal of Red Rock Bridge over Colorado River on U. S. 66. New Topock underpass at left and abandoned Old Trails Arch at right

HIGHWAY HISTORY

The highway crossing has an even longer and more varied history. Jebediah Smith forded the Colorado River 10 miles north of Topock in 1826 to trade with the native Indians and Capt. Sitgreaves for the same purpose in 1850. Whipple, making the Thirty-fifth Parallel Railroad Reconnaissance in 1854, and Beale, breaking the Thirty-fifth Parallel Wagon Trail in 1857, forded 25 miles upstream from Topock, at the north end of the same (Mojave) valley. Later in 1863 Captain Hardy established the first ferry at Hardyville, a little farther upstream.

In 1890 the Needles Ferry was inaugurated, but service was often interrupted by shoaling of the main channel or flooding of the bottom lands east of the river. It was abandoned in 1921.

The National Old Trails Highway, now U. S. 66, was being promoted in 1914 when a flood took out the Needles Ferry and reduced the Arizona approach to a four-mile quagmire. The States of Arizona and California, the County of San Bernardino and the United States Indian Service joined to build the highway arch bridge which is now being abandoned. Meanwhile Red Rock Bridge was planked for an emergency highway connection and maintained as such until the arch bridge was completed on February 20, 1916.

Located 800 feet downstream from the massive Red Rock Bridge, the Old Trails Arch Bridge was a delicate companion structure. Designed by J. A. Sourwine, it was for 12 years the longest three-hinged arch in the United States. Although it had been posted for a load limit of 11 tons with the warning "One Way for Trucks and Busses," neither was a serious restriction for light and infrequent traffic across the desert until wartime transport and desert maneuvers of heavy military equipment were blocked. Even that was recognized as a temporary demand, but the closure of Parker Dam March 4, 1938, backed Lake Havasu 45 miles up the river to submerge the abutments and lower hinges of the arch bridge. The stage is kept high, making inspection of these supports impractical, and future effectiveness of protection applied to steel surfaces was very uncertain.

Since Parker Dam was undertaken, studies of alternative highway routes have anticipated abandonment of the arch bridge. The Red Rock site remained the best bridge site. Three other sites south of Needles having some advantages were threatened by the delta forming upstream from Lake Havasu. Two others just north of Needles have been surveyed and more recently it has been proposed that U. S. 66 be relocated to cross on Davis Dam 30 miles above Needles. However acquisition of Red Rock Bridge will post-

Old Trails Arch (Bridge 54-18) over Colorado River before Lake Havasu flooded the lower hinges. Topock, Arizona, in background



pone need for a change far into the future.

DEVELOPMENT OF RED ROCK BRIDGE

The Red Rock Cantilever Bridge, as it was first called, was ordered from the Phoenix Bridge Company after submission of competitive designs. It was designed by Dr. J. A. L. Waddell, with Prof. Stillman W. Robinson as Consulting Engineer on superstructure. The project was daring for the times, it being one of the first steel bridges and at that time the longest cantilever bridge in the Americas. Samuel M. Rowe, was Chief Engineer at the site and was responsible for substructure, which included the sinking of a caisson to a record depth of 91.5 feet below high water. Albert A. Robinson, Chief Engineer of Atchison, Topeka and Santa Fe Railway Company, directed the project as a whole.

Proportions and significant data were:

Cost, dollars	$462,434
Gross length, feet	1,110
Suspended span, feet	330
Main span, feet	660
Width, c. to c. trusses, feet	25
Elevation of deck	504
Elevation of cutting edge	366

BRIDGE STRENGTHENED

Although designed for two 94-ton engines trailing 3,000 pounds per lineal foot, a load so heavy that equipment was not available for a test, the margin of safety dwindled as locomotives grew. The floor and lateral system were strengthened in 1901, but by 1911 no ordinary measures could keep the bridge in step with heavier rolling stock.

After considering alternatives of relocation and of new superstructure, a channel pier was added under the midpoint of the suspended span. The bridge was no longer a *cantilever*, and that part of the name was dropped. Reversals of stress required extensive reinforcement, particularly of tension members which were now compressed.

Since then locomotives have grown swifter rather than heavier and the bridge was obsolescent because of delay caused by the gauntlet track on the bridge and the nine-degree curve at its west approach. These, and not age or weakness, led to the development of the new railroad line and bridge.

The original 660-foot span of the bridge had required the spacing of trusses 25 feet apart for lateral stiffness, and this spacing made the bridge adaptable for highway purposes. Very little change of framework was necessary in the transformation because the trusses were more than adequate for legal-limit highway loads.

The deck was transformed by respacing the stringers to support 14-inch wide-flange 30-pound subfloor beams, on which the seven-inch reinforced concrete roadway slab was poured. A skid rail to protect truss members was built into the guard railing.

Contract for these alterations was let October 6, 1945, to H. L. Royden of Phoenix, but not completed until May 21, 1947, because of scarcity of steel and scheduling to avoid hot weather. As the work exposed the old steel, it was found to be in excellent condition. Tops of a few stringers had corroded to depths of three-eighths inch, or half way through the flange, because of accumulation of brine drip from reefers. However the remaining strength was sufficient for highway loads and these flanges were simply cleaned and protected.

Plans for alterations were under the direction of R. A. Hoffman, Engineer of Bridges and Dams for the Arizona Highway Department. California was represented in discussion of general plans by F. W. Panhorst, Bridge Engineer. Attorney Frank B. Durkee of the California State Department of Public Works, made the legal review and drafted the bill for congressional action.

FOLLOW THESE RULES TO PREVENT FOREST FIRES

Attention hunters, fishermen, campers, motorists, tourists! The United States Forest Service calls upon you to help prevent forest fires by following these rules:

Observe the no-smoking regulations in certain areas. Stop in safe places to smoke.

Crush out your cigarette, cigar or pipe ashes.

Never throw a burning object from the window of an automobile or railway coach.

After using a match, break it in two. When you can hold the burned end between your fingers, indicating that it is completely out, play safe anyway and use an ash tray instead of throwing away the pieces of the match.

If you must use a fire—first, ask if the law requires a permit; then, have help handy in case of emergency; last, kill every spark.

Controlled Access Express Highways Mean More Safety

COMMENTING upon the President's Highway Safety Conference held recently in Washington, D. C., to evaluate results of a year's nation-wide effort to reduce death and injury on the highways and to plan a further attack on highway accidents, Charles M. Upham, Engineer-Director of the American Road Builders' Association, said:

"The problem of highway safety affects each of us. Thirty years ago, the average American traveled 450 miles a year by all forms of transportation. Today, he travels 4,000 miles a year by motor vehicle alone.

"Thirty-four million vehicles—some new and some ready for the junk heap. Forty-four million drivers—some good and some bad. Millions of pedestrians. And each week, some 100,000 new vehicles join the millions on our 3,250,000 miles of roads and streets. Daily the battle against death on the highway becomes more complex.

"Vehicle mileage in 1947 will set a new record and most of it will be driven on inadequate and obsolete highways.

"Our roads have always lagged behind the vehicle. Not until 1920 did road building really get under way. We had 9,000,000 cars on the highways then. The volume of traffic multiplied six times between 1920 and 1940, and motor vehicles increased almost four times in number.

"Some 27,000 miles of federal aid highways and 60,000 to 80,000 miles of roads maintained by the states need rebuilding to safer standards. We have 14,000 miles of two-lane primary highways that are carrying four-lane traffic. Inadequate and congested roads and streets with hazards in every mile take their toll in human life.

"Our heavily traveled main highways with cross traffic and uncontrolled exits and entrances take a huge annual death toll. Safety demands that they give way to controlled access express highways with sufficient traffic capacity and freedom from congestion.

"Accident records on such highways in California, Connecticut, New York and New Jersey prove that improved highway design contributes large gains in highway safety."

Prunedale Freeway Cut-off Completed

THE PRUNEDALE Freeway Cut-off from Santa Rita to 0.8 mile north of Crazy Horse Summit in Monterey County has been recently completed and opened for the use of public traffic.

This improvement was accomplished by constructing two additional lanes adjacent to the existing two-lane section, thereby providing a modern four-lane divided, controlled access freeway. Traffic has been relieved of one of the most congested sections on the El Camino Real. This congestion was caused by the slowing up of trucks on the steep grades, thereby holding up faster moving automobiles and creating definite driving hazards where safe driving rules were not followed. The numerous curves also added to the restricted number of "no passing" zones.

The existing 20-foot portland cement concrete highway, which now forms two lanes of the divided highway, was opened to traffic on July 20, 1932, and supplanted the narrow, twisting San Juan grade, which increased speed and volume of traffic had made obsolete after 17 years of service. The continued increase in traffic on the main arterial of the coast route between the metropolitan areas of San Francisco and Los Angeles, resulted in traffic rising from 3,000 to 4,000 vehicles daily in 1932 when the Prunedale Cut-off was completed, to traffic of 6,000 to 9,000 vehicles in 1941, of which over 10 percent were trucks and trailers.

The completed project is 8.4 miles in length and comprises the first unit of the freeway. The second unit, 6.7 miles in length, which has its northerly terminus at Chittenden Road near San Juan Bautista, is well advanced, completion being scheduled for early in October, 1947. The total length of the freeway will be 15.1 miles. The cost of the first unit was about $845,000 and the estimated cost of the second unit is approximately $770,000, making a total cost of $1,615,000. Limited access right of way was aequired at a cost of $155,000.

The construction consisted of grading a 39-foot roadbed for the two additional lanes and surfacing it with a three-inch thickness of plant-mixed surfacing on a one-foot thickness of crusher run base over a selected or imported borrow subbase having a minimum thickness of six inches and a maximum of 12 inches depending upon the quality of the underlying materials. The shoulders, gutters and inside face of the embankment dikes are surfaced with three inches of plant-mixed surfacing. A seal coat of asphaltic emulsion and medium fine screenings was applied to the plant-mixed surfacing on the 23-foot traffic lanes.

The construction crossed several unstable marshy areas composed of saturated, unstable, clayey sand, soft plastice clay and peat to depths of 3 to 14 feet. These areas were stabilized by removing the saturated unstable material to the underlying solid material, installing eight-inch perforated metal pipe underdrains and blind stone drains as required to carry off the seepage and back filling the excavated areas with material selected from roadway exeavation or imported borrow. Materials exeavated from these areas, which were suitable for use in eonstrueting embankments, when not saturated were dried out and placed in adjacent embankments. Some of the fill treatment material was utilized to construct supporting fills against the previously con-

View of transitions on four-lane divided highway where existing concrete pavement changes from right to left set of lanes. Central dividing strip defined by traffic stripe and raised bars







Upper—View showing erosion protection on embankment slope. Lower—Typical view of new four-lane divided highway developed from existing two-lane highway

structed road embankments and the more humus material was used for topsoiling embankment slopes and division strips. The extent of this work is indicated by the fact that it involved 166,000 cubic yards of fill treatment excavation, 2,500 cubic yards of sand filling material, 4,000 cubic yards of filter material (underdrains), and 5,000 lineal feet of eight-inch perforated metal pipe underdrains.

The erosive nature of the materials on this project required that the embankment and cut slopes be treated to preclude excessive future maintenance costs. The excavation slopes were covered with topsoil removed from within the roadway prism. Six-ten-six fertilizer was mixed with the topsoil at the approximate rate of 20 pounds for each 110 square yards of slope area. Straw was spread over the excavation slopes and shoved into the loose surface. Humus topsoil was selected from the fill treatment excavation and placed over embankment slopes and the central dividing strip. The slope areas were seeded to provide an early protective growth of vegetation. Mesembryanthemum edule (ice plant) cuttings were planted on the excavation slopes, along the tops of the embankment slopes and in the central dividing strip.

The alignment and grade of the two new lanes, in general, followed along adjacent to the existing pavement. The only major deviation from this position is at the "Pineeate Rocks," a bandit lair in the early days, where the existing highway passed through a narrow gorge. The new lanes were located 600 feet northerly of the present road to avoid the destruction of the scenic and historical "Rocks." At the junction of Route 22 to San Juan Bautista, the new lanes were positioned away from the existing roadbed in order to require minimum alteration of the roadside beautification at this intersection. This beautification consists of a cross, campanile with mission bells and adobe walls and curbs around landscaped areas, which provide a historical land-

(Continued on page 31)



"Send Tow Truck," radios pickup truck operator on San Francisco-Oakland Bay Bridge. One minute later a tow truck arrived to haul away the car. Bridge traffic operations have been greatly expedited through the use of two-way FM radiotelephones

Two-Way Mobile Radio System Installed On San Francisco-Oakland Bay Bridge

(Continued from page 19)

against sponge rubber gaskets, making them weatherproof and yet easily dismantled. Transmitters and receivers on the tow trucks are mounted one above the other in their cabinets with adequate spacing to permit testing without the necessity of removing either unit from the cabinet. On the pickup trucks, the two units are mounted side by side. By mounting pickup truck cabinets on angle iron spreaders resting on the tops of the body sideboards, the full length of the pickup body is available for normal load.

Antenna assemblies, approximately 17 feet long, are mounted on the tops of the truck cabs. Co-axial lead-ins are concealed in cab walls and ceilings or are installed in one-fourth inch copper tubing wherever this is not possible. Wires and cables from the dashboard-mounted control units and battery to the transmitter-receiver assembly are installed in 1½-inch flexible steel conduit.

The main station is located at the Toll Plaza Administration Building. A triple-skirt, high-gain antenna is installed on the roof of the penthouse atop the building, approximately 60 feet above ground. The transmitter is mounted in the penthouse, requiring a very short lead-in. Two remote control units are used to operate the transmitter, one in the dispatcher's office on the ground floor, and the other at the tow car garage and firehouse on Yerba Buena Island, midway point on the bay crossing. Intercommunication between the remote control units is possible by the operation of a talk-listen key. Dispatching during daylight hours is done from the dispatcher's office at the Toll Plaza, and after dark from the firehouse on Yerba Buena Island.

The radio installation has been in service since April 25, 1947, and has proved to be all that was expected of it. Former communication problems involving matters of minutes may now be said to be matters of seconds. To this extent the orderly movement has been materially assisted.

$76,000,000 Annually For New Construction On State Highways

(Continued from page 7)

4½ cents per gallon, allocated in the proportion of five-eighths of a cent to the cities and 1⅜ cents to the counties. To the State will be allocated the revenue from the remaining 2½ cents for administration, rights of way, engineering, maintenance and improvements on the State Highway System and for construction of new state highways, including metropolitan freeways.

As to expenditure of funds allocated to cities, it is provided that three-fifths shall be expended for *construction* of major city streets and two-fifths for *maintenance* of major and secondary city streets.

Recognition is also given in the Collier-Burns Act to the need for developing metropolitan freeways. To this end the new law adds approximately 67 miles of city streets to the state highway system. It is presumed that much of this metropolitan state highway mileage will be improved to freeway standards as traffic conditions require, and as funds are available.

The act sets up a formula for expenditure of funds upon the critical deficiencies of the State Highway System in each county, so as to assure continuity in a state highway construction program on a state-wide basis. This formula applies to 50 percent of the state highway funds available for construction purposes during the first five-year period, 55 percent during the next five years, and 65 percent during the third five years.

The act further provides that the northern group of counties are to receive 45 percent of the revenue available for state highway construction, and the southern counties 55 percent.

The State Department of Public Works is required to make detailed reports to the Governor and the Legislature with respect to highway revenues and expenditures, and the Director of Finance is given budgetary control over the transfer of funds from one project to another.

SEATTLE PUBLIC LIBRARY

In Memoriam

R. L. Young

DISTRICT Construction Engineer, R. L. Young, died June 20th in San Bernardino. Mr. Young is survived by his widow, Mary Elizabeth Young and his sisters, Elizabeth Young and Laura May Young Harper of Fredonia, New York.

Mr. Young was born April 17, 1882 in Fredonia, New York. He was a graduate of Syracuse University. Mr. Young was a star athlete at Syracuse University. He met and married Mrs. Young in the university town of Syracuse. Following his graduation he accepted the position of Athletic Director at Oklahoma Agriculture and Mechanical College, where he remained for two years. Following this, Mr. Young was employed by the Barbour Asphalt Company, New Orleans, and gained his first practical experience in the road construction industry. At a later date, he came to California and was employed by the City of Los Angeles as an engineer in the road construction department.

Mr. Young has been an employee of District VIII since the formation of the District in 1923. He was promoted to District Construction Engineer in 1928. He entered state service in 1921 in Los Angeles. Mr. Young's work for the State was of exceptional excellence. His genial, kindly manner, his firmness and integrity made him unusually well suited to the control of contract work under his jurisdiction. He was universally respected by everyone with whom he came in contact.

Mr. Young's work with the State was his entire life's interest. During his last illness, until the time of his death, his principal interest was in continuing to discuss the problems of highway construction.

Harry J. Johnstone

ON MONDAY, May 19, 1947, the Maintenance Department lost one of its most valuable employees, Harry J. Johnstone, who worked with the tree crew with headquarters at Petaluma.

Mr. Johnstone went to work with the department in 1931 and worked steadily since that time with tree crews in various parts of the State. He transferred from District V in 1943, and until the time of his death was a resident of Petaluma. He lost his life in the line of duty when he was struck by a passing vehicle on El Camino Real in South San Francisco.

Funeral services were held in Petaluma on May 22, 1947, and he is now resting at Calvary Cemetery in the same city. Besides his widow, Florence Johnstone, he leaves a daughter, Naomi, age nine. The district extends its heartfelt sympathy to those who survive him.

William Alva Rice

THE DEATH of William Alva Rice on April 6, 1947, came as a shock to his many friends and associates in the Division of Highways, in spite of his having been hospitalized for several months with heart trouble.

"Bill," as he was affectionately called, was born in Knoxville, Tennessee, on November 28, 1892. He received his early education in eastern grammar and high schools. He served his Country during World War I in the United States Navy as a Pharmacist Mate. In 1919 he entered the services of the Division of Highways and had been with District IV since 1922.

Mr. Rice became Resident Engineer in 1928 and faithfully carried out the duties of that position until he became ill. Among his many achievements during his career was his supervision of most of the construction and all of the paving of the entire Bayshore Highway between San Francisco and San Jose.

Mr. Rice was highly esteemed by his friends and fellow workers and by others who knew him. He was kind, yet firm to his subordinates and always a friend to the needy. His business associates admired him because of his honesty and frankness. He was a member of Theodore Roosevelt Post No. 21, American Legion, of Santa Rosa, California.

Mr. Rice is survived by his widow, Mrs. Theresa Pauline Rice, and one daughter, Lois Marian, who reside in San Rafael, California.

Clyde A. Graham

EMPLOYEES of District VII were shocked and deeply grieved at the sudden death of Clyde A. Graham, District VII Chief Clerk at his home in Los Angeles on June 14, 1947. Although his length of service in District VI was comparatively short, he became one of the most popular members of the district organization where his loss will be keenly felt, both as a friend and as an efficient and loyal worker.

Clyde was born in Kerrville, Texas, February 16, 1900. His parents moved to San Francisco in 1906, and thence to a cattle ranch in the vicinity of Auburn. After completion of his primary and secondary school courses he attended the University of California, and later the University of Nevada.

Clyde entered the state service in District I in 1922 as clerk, and was transferred to Headquarters Shop in 1928. He was later appointed Chief Clerk in District VI, and in 1944 was transferred to District VII in the same capacity.

He always felt a keen interest in railways and train equipment and at one time worked as a locomotive fireman for the Southern Pacific Company. He had as a hobby the construction of model railroads, locomotives and cars, and was an active member of the Metropolitan Railroad Club. Clyde was also an excellent golfer, and for some time was chairman of the Greens Committee of the Fort Washington Golf Club at Fresno.

He left many friends in nearly every part of the State, and the numerous expressions of sympathy to his family and to the district office give some indication of the high esteem in which he was held, both as an employee and as a man.

Mr. Graham is survived by his widow, Mabel Gammon Graham, a daughter Suzanne Graham, 14, and a son Thomas H. Graham, 11.

Zacharias Crespo

DISTRICT II is mourning the death of Zacharias Crespo, member of the Quarter Century Club of the Division of Highways. Mr. Crespo started work with the State in 1912 on a survey party. He later joined the Maintenance Department and was foreman with headquarters in Redding. He retired on account of illness during the year 1938 and died at the age of 60 of a heart attack on May 2, 1947.

Mr. Crespo was a World War I veteran, having served overseas. He is survived by his widow, Elen Crespo, and his son Maurice Crespo, who is soon to graduate from University of California as a civil engineer. He also leaves a sister, Mrs. Flora Silva, of Oakland.

He will be greatly missed by his many friends in District II and in Sacramento.

Highway Bids and Contract Awards for June and July, 1947

June, 1947

ALAMEDA COUNTY—Between Toll Plaza and Distribution Structure, about 0.9 mile, additional traffic lanes to be constructed of crusher run base and asphalt concrete and a timber trestle to be constructed. District IV, Route 5. Lee J. Immel, San Pablo, $152,094. Contract awarded to Chas. L. Harney, Inc., San Francisco, $126,672.30.

ALAMEDA COUNTY—On East Shore Freeway, between one mile north of south city limits of Oakland and 0.3 mile south of High Street in Oakland, about 2.3 miles to be graded. District IV, Route 69. San Francisco Bridge Co., San Francisco, $1,094,020; Hydraulic Dredging Co., Ltd., Oakland, $1,124,465. Contract awarded to Johnson Western-American, Alameda, $897,185.

ALAMEDA COUNTY—Over East Shore Freeway at 23d Avenue in the City of Oakland, an overcrossing to be constructed. District IV, Route 69. Stolte Inc. & The Duncanson Harrelson Co., San Francisco, $469,089; Clinton Construction Co., San Francisco, $482,682; Guy F. Atkinson Co., South San Francisco, $493,539; Chas. L. Harney, San Francisco, $495,785; Carrico & Gautier, San Francisco, $496,772; Parish Bros. & Lew Jones Construction Co., Benicia, $506,785; S. J. Amoroso Construction Co., San Francisco, $509,343; Fredrickson & Watson Construction Co., Oakland, $525,857. Contract awarded to A. Soda & Son, Oakland, $468,346.84.

ALAMEDA COUNTY—Over East Shore Freeway at 29th Avenue in the City of Oakland, a reinforced concrete and structural steel overcrossing to be constructed. District IV, Route 69. S. J. Amoroso Construction Co., San Francisco, $158,402; A. Soda & Son, Oakland, $159,441; Carl N. Swenson Co., Inc., San Jose, $164,109; Leo Epp, San Francisco, $166,435; Stolte Inc. & The Duncanson-Harrelson Co., San Francisco, $167,935; Carrico & Gautier, San Francisco, $169,982; Chas. L. Harney, Inc., San Francisco, $170,136; Dan Caputo & Edward Keeble, San Jose, $170,841; Earl W. Heple, San Jose, $171,072; Fredrickson & Watson Construction Co., Oakland, $183,652; M. & K. Corp., San Francisco, $195,570. Contract awarded to Lew Jones Construction Co., San Jose, $156,215.

ALAMEDA AND CONTRA COSTA COUNTIES—Between Hayward and Dublin and between Danville and 3.1 miles south, about 5.3 miles, portions to be repaired by placing plant-mixed surfacing over the existing pavement and a portion to be repaired by placing crusher run base and plant-mixed surfacing over the existing pavement. District IV, Routes 5, 107, Sections B, A. Lee J. Immel, San Pablo, $171,010; A. S. Jones, Napa, $179,830; N. M. Ball Sons, Berkeley, $158,858; W. C. Railing, Redwood City, $166,166; Independent Construction Co., Ltd., Oakland, $194,880. Contract awarded to J. R. Armstrong, El Cerrito, $158,462.80.

AMADOR COUNTY—In the vicinity of Jackson, about 2.3 miles to be graded and surfaced with plant-mixed surfacing and 3 reinforced concrete bridges to be constructed. District X, Routes 34, 65, Sections Jkn, C. Piombo Construction Co., San Francisco, $496,717. Contract awarded to Fredrickson Bros., Emeryville, $489,334.20.

AMADOR AND CALAVERAS COUNTIES—Repairing a bridge across Mokelumne River, about 4 miles south of Jackson, District X, Route 65, Sections C.A. Bos Construction Co., Oakland, $4,305; J. D. O'Brien, Stockton, $5,258; Moore Dry Dock, Oakland, $7,750; Lord & Bishop, Sacramento, $8,050; Fred D. Kyle, Pasadena, $8,771. Contract awarded to Chas. Scott, Stockton, $3,966.53.

CONTRA COSTA COUNTY—In El Cerrito and Richmond on San Pablo Avenue, between Stockton Avenue and McBryde Avenue, furnishing and installing traffic signal systems at 10 intersections. District IV, Route 14, Sections E.Cr., Rch. Abbett Electric Co., San Francisco, $72,067. Contract awarded to Severin Electric Co., San Francisco, $59,649.90.

EL DORADO COUNTY—Between Georgetown and U. S. Ranger Station, about 3.6 miles to be graded and surfaced with imported base material, and penetration treatment and seal coat applied. District III, Route 1099. Dix-Syl Construction Co. Inc., Bakersfield, $78,325.80; H. & D. Construction Co., San Anselmo, $82,289; Arthur B. Siri, Santa Rosa, $83,313; Louis Biasotti & Son, Stockton, $96,495; Chittenden & Chittenden, Auburn, $108,483; Claude C. Wood Co., Lodi, $109,512. Contract awarded to Miles & Bailey, Madera, $72,319.50.

FRESNO COUNTY—Between 400 feet south of Fresno city limits and San Benito Avenue at Broadway in Fresno, about 1.2 miles to be graded, paved with Portland cement concrete pavement and plant-mixed surfacing on cement treated base and grade separation structures to be constructed. District VI, Route 4, Sections B,Fre. Morrison Knudsen Co. Inc., San Francisco, $1,452,644; Bressi & Bevanda Constructors, Inc., Los Angeles, $1,533,563; A. Teichert & Son, Inc., Sacramento, $1,582,724; J. E. Haddock, Ltd., Pasadena, $1,686,454. Contract awarded to Guy F. Atkinson, South San Francisco, $1,341,822.

FRESNO COUNTY—On Highland Avenue between Kings County line and Elkhorn Avenue, about 3.3 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District VI, Route 568. Volpa Brothers, Fresno, $149,823; R. M. Price Co. & Rex B. Sawyer, Huntington Park, $157,795. Contract awarded to Valley Paving and Construction Co. Inc., Fresno, $137,641.50.

HUMBOLDT COUNTY—Between Jordan Creek and South Scotia Bridge, about 1.2 miles, cement treated base to be constructed on a portion of the project and plant-mixed surfacing and seal coat to be placed on the cement treated base and existing surfacing. District I, Route 1, Sections D,E. Contract awarded to Clements & Co., Hayward, $30,644.

HUMBOLDT COUNTY—Across Redwood Creek, about 30 miles east of Eureka, a structural steel truss span bridge to be constructed. District I, Route 20, Section C. C. C. Gildersleeve, Douglas City, $17,483; James H. McFarland, San Francisco, $23,760; W. C. Railing, Redwood City, $24,735. Contract awarded to Tom Hull, Eureka, $14,948.

IMPERIAL COUNTY—Between Junction Route 26, 1.5 miles east of Heber and 1.9 miles south of Calipatria and between 3.6 miles north of Bond's Corner and Alamorio, about 12.0 miles in net length, to be repaired by placing road-mixed surfacing over the existing surfacing and portions to be repaired with imported base material and road-mixed surfacing. District XI, Routes 201, 187, Sections ABC, ABC. Warren Southwest Inc., Los Angeles, $86,911; Cec-Tee Construction Co., Puente, $88,845; R. E. Hazard Contracting Co., San Diego, $89,176; Shea & Fisher Inc., Indio, $92,494; Dimmitt & Taylor, Los Angeles, $96,321. Contract awarded to MacArthur & Son, Palmdale, $79,577.

KERN COUNTY—Between Bakersfield and Snow Road, about 3.6 miles to be graded, paved with Portland cement concrete and with asphalt concrete and plant-mixed surfacing on Portland cement concrete base and on crusher run base, and four reinforced concrete bridges and two steel girder bridges to be constructed. District VI, Routes 4, 141, Sections Bkd, G,D,A. Morrison-Knudson Co., Inc., San Francisco, $1,334,419. Contract awarded to Griffith Company, Los Angeles, $1,210,040.

KERN COUNTY—Between 0.4 mile west of Cottonwood Creek and Cottonwood Creek, about 0.4 mile to be scarified and reshaped and "sub-oiling" treatment applied. District VI, Route 57, Section E. Contract awarded to James E. Anderson, Visalia, $4,105.

KERN COUNTY—Remove existing bridge across Kern River on Oak Street at Bakersfield. District VI, Route 58, Section L. George von KleinSmid, Bakersfield, $12,220; Phoenix Construction Co., Bakersfield, $12,440; Trewhitt-Shields & Fisher, Fresno, $15,973. Contract awarded to Rexroth & Rexroth, Bakersfield, $12,220.

KERN COUNTY—Between Wasco and Elmo Highway, about 6.1 miles to be graded and bituminous surface treatment applied. District VI, Route 889. Splicer Company, Los Angeles, $184,768; Dix-Syl Construction Co., Inc., Bakersfield, $185,893; Browne & Krull, Palo Alto, $188,886; Fredericksen & Kasler, Sacramento, $196,095; Frank T. Hickey, Inc., Los Angeles, $218,156; Oilfields Trucking Co., Bakersfield, $226,407; Claude C. Wood Co., Lodi, $227,158; Louis Biasotti & Son, Stockton, $236,205; W. C. Railing, Redwood City, $236,346. Contract awarded to Rand Construction Co., Bakersfield, $167,805.50.

LOS ANGELES COUNTY—On Whittier Blvd. between Goodrich Blvd. and Concourse Avenue, furnishing and installing traffic signal systems at eight intersections. District VII, Route 2, Section D,Mtbl. C. D. Draucker Co., Los Angeles, $35,375. Contract awarded to Econolite Corp., Los Angeles, $30,668.

LOS ANGELES COUNTY—At the intersection of Hollywood Parkway and Arroyo Seco-Harbor Parkway, a four level reinforced concrete separation structure to be constructed, approaches to be graded, and storm drains and sanitary sewers to be installed. District VII Routes 2, 165. Guy F. Atkinson Co., Long Beach, $1,437,700; Bressi & Bevanda Constructors, Inc., Los Angeles, $1,619,739; J. E. Haddock Ltd., Pasadena, $1,627,124; M. H. Golden Construction Co., San Diego, $1,638,540; Peter Kiewit Sons Co., Arcadia, $1,786,882; Winston Bros. Co., Los Angeles, $1,946,817. Contract awarded to James I. Barnes Construction Co., Santa Monica, $1,296,595.40.

LOS ANGELES COUNTY—Across San Gabriel River near Azusa, a portion of a bridge to be reconstructed. District VII, Route 9, Section G. Macco Corp., Clearwater,

$45,861; H. R. Breeden, Compton, $47,335; Jas. R. Mathews Excavating Co., Alhambra, $48,615; Oberg & Cook, Los Angeles, $50,425; T. M. Page, Monrovia, $53,416; C. B. Tuttle Co., Long Beach, $54,159; Oberg Bros., Ingelwood, $59,092; MacDonald & Kruse & Hensler Construction Corp., Glendale, $61,788; Dimmitt & Taylor, Los Angeles, $69,815; Byerts & Dunn, Los Angeles, $70,648; Catalina Construction Co., Covina, $71,133. Contract awarded to Bonadiman McCain, Inc., Los Angeles, $45,618.15.

LOS ANGELES COUNTY—In the City of Pomona on 5th Avenue and on Holt Avenue from Hamilton Blvd. to Reservoir Street, furnishing and installing traffic signal systems at 13 intersections and furnishing and installing modifications to existing traffic signal systems at three intersections. District VII, Routes 19 and 26. H. B. Nicholson, Los Angeles, $48,659; Econolite Corp., Los Angeles, $52,908; C. D. Draucker Co., Los Angeles, $53,150. Contract awarded to Prescott Electric & Mfg. Co., Los Angeles, $44,770.

LOS ANGELES COUNTY—On Garvey Avenue between San Gabriel Blvd. and Mountain View Road, furnishing and installing traffic signal systems at 13 intersections and reconstructing traffic signal systems at 2 intersections. District VII, Route 26, Sections A, B, E, Mtc. Econolite Corp., Los Angeles, $53,195. Contract awarded to C. D. Draucker Co., Los Angeles, $52,170.

LOS ANGELES COUNTY—At the intersection of Holt Avenue and Bellevue Avenue, about 0.5 mile, existing pavement to be resurfaced with asphalt concrete and widened with asphalt concrete on Portland cement concrete base. District VII, Routes 26, 77; Sections C, B, J. E. Haddock, Ltd., Pasadena, $73,154; Silva & Hill Construction Co., Los Angeles, $75,911; Dimmitt & Taylor, Los Angeles, $80,540; MacDonald & Kruse & Hensler Construction Corp., Glendale, $116,342. Contract awarded to Griffith Co., Los Angeles, $69,281.70.

LOS ANGELES COUNTY—At the intersection of Holt Avenue and Bellevue Avenue, traffic signal and highway lighting systems to be furnished and installed. District VII, Routes 26, 77, Sections C, B, C. D. Draucker Co., Los Angeles, $30,470. Contract awarded to Econolite Corp., Los Angeles, $28,678.

LOS ANGELES COUNTY—In the cities of Arcadia and Monrovia, on Huntington Drive from Colorado Place to Mountain Avenue, furnishing and installing traffic signal systems at 11 intersections. District VII, Routes 161, 9. Prescott Electric & Manufacturing Co., Los Angeles, $39,992; C. D. Draucker Co., Los Angeles, $44,070; Econolite Corp., Los Angeles, $46,211. Contract awarded to Electric and Machinery Service, Inc., South Gate, $38,880.

LOS ANGELES COUNTY—In the cities of Lynwood and South Gate on Atlantic Avenue from Century Blvd. to Firestone Blvd., furnishing and installing traffic signal systems at 8 intersections and reconstructing traffic signal system at one intersection. District VII, Route 167. H. B. Nicholson, Los Angeles, $32,070; C. D. Draucker Co., Los Angeles, $32,500; R. E. Ziebarth, Long Beach, $38,000. Contract awarded to Econolite Corp., Los Angeles, $29,795.

MENDOCINO COUNTY—At Kibbesillah Creek, 11.6 miles north of Fort Bragg, about 0.5 mile to be graded, surfaced with road-mixed surfacing on imported base material, and a seal coat to be applied. District I, Route 56, Section F. John Burman & Sons, Eureka, $73,391; Guy F. Atkinson Co., South San Francisco, $73,851; W. C. Railing, Redwood City, $82,892. Contract awarded to Arthur B. Siri, Santa Rosa, $71,923.

MENDOCINO COUNTY—Across Noyo River, about one mile south of Fort Bragg, the superstructure for a bridge to be constructed. District I, Route 56, Section E. Guy F. Atkinson Company, South San Francisco, $472,205; George Pollock Co., Sacramento, $479,615; Columbia Steel Company, San Francisco, $471,335. Contract awarded to J. H. Pomeroy and Co., Inc., San Francisco, $459,532.50.

MODOC COUNTY—Furnishing and stockpiling mineral aggregate. District II, Route 28, Section A. Contract awarded to Harms Bros., Sacramento, $14,975.

MODOC COUNTY—Across South Fork of Pit River, at Likely, a reinforced concrete bridge to be constructed. District II, Route 73, Section C. Evans Construction Co. and Barton & Anderson, Berkeley, $48,288; Grant L. Miner, Palo Alto, $38,865. Contract awarded to T. A. Krale, Ojai, $34,885.

MONO COUNTY—Near Bridgeport, on Twin Lakes Road, about 3.9 miles to be graded and bituminous surface treatment applied. District IX, Route FAS 1093. Geo. E. France, Visalia, $63,280; Isbell Construction Co., Reno, $64,955; Jensen and Pitts, San Rafael, $75,109; Browne and Krull, Palo Alto, $96,268. Contract awarded to Dix-Syl Construction Co., Inc., Bakersfield, $47,384.50.

NEVADA COUNTY—Between East Broad Street in Nevada City and two miles northwesterly, about 1.9 miles to be constructed with a bituminous surface treatment on imported borrow. District III, Route 25, Section Nev. C. A. Jensen & Pitts, San Rafael, $59,428; A. Teichert & Son, Inc., Sacramento, $63,029; Arthur B. Siri, Santa Rosa, $74,033. Contract awarded to J. Henry Harris, Berkeley, $58,973.35.

NEVADA, PLACER & EL DORADO COUNTIES—Seal coat to be applied at various locations in District III, Routes 37, 38, 39, 11, A. Teichert & Son, Inc., Sacramento, $47,300; Fredericksen & Kasler, Sacramento, $48,493; J. Henry Harris, Berkeley, $50,462. Contract awarded to Granite Construction Co., Watsonville, $44,788.

ORANGE COUNTY—In the City of Laguna Beach on Coast Blvd. from Diamond Street to Myrtle Street, furnishing and installing fixed time traffic signals at five intersections and reconstructing fixed time traffic signals at six intersections. District VII, Route 60. Electric Machinery Service, Inc., South Gate, $22,615; R. E. Ziebarth, Long Beach, $24,950; C. D. Draucker Co., Los Angeles, $27,770. Contract awarded to Tri-Cities Electric Service, Oceanside, $20,825.

ORANGE COUNTY—Between one mile south of Galivan and 1.4 miles north of El Toro Road, about 6.7 miles, about one mile of the existing pavement to be resurfaced with plant-mixed surfacing, imported borrow to be placed on shoulders and bituminous surface treatment applied thereto; and about 2.4 miles imported borrow to be placed on shoulders and bituminous surface treatment applied. District VII, Route 2, Sections A, B. Sully-Miller Contracting Co., Long Beach, $18,222; Cox Bros. Construction Co., Stanton, $16,905. Contract awarded to Jesse S. Smith, Glendale, $15,015.

PLACER AND YOLO COUNTIES—At Sheridan, on the Yolo Causeway, and through Loomis, about 3.6 miles, to be resurfaced with plant-mixed surfacing. District III, Routes 3, 6, & 17. Sections B, B, A. McGillivray Construction Co., Sacramento, $16,812. Contract awarded to A. Teichert & Son, Inc., Sacramento, $15,586.

SACRAMENTO COUNTY—Across Three Mile Slough about 4.3 miles south of Rio Vista, the reinforced concrete substructure for a bridge to be constructed. District X, Route 11, Section C. The Duncanson-Harrelson Co., San Francisco, $246,660; H. F. Lauritzen, Pittsburg, $249,352; Healy Tibbitts Construction Co., San Francisco, $286,035; Ben C. Gerwick, Inc., San Francisco, $331,901; Butte Construction Co., San Francisco, $332,706. Contract awarded to Johnson Western Company, Alameda, $237,229.80.

SACRAMENTO COUNTY—On Marconi Avenue between Howe Avenue and Fair Oaks Boulevard, about 4.7 miles to be graded and crusher run base constructed, and plant-mixed surfacing, armor coat and penetration oil treatment to be applied. District III, Route 929. A. Teichert & Son, Inc., Sacramento, $109,663; Brighton Sand & Gravel Co., Sacramento, $111,221. Contract awarded to McGillivray Construction Co., Sacramento, $106,379.95.

SAN BENITO COUNTY—Between Route 2 and San Juan Bautista, about 2.2 miles to be repaired by placing imported borrow over the existing roadbed and applying bituminous surface treatment. District V, Route 22, Section C. Granite Construction Co., Watsonville, $35,780. Contract awarded to A. Teichert & Son, Inc., Sacramento, $32,993.

SAN BERNARDINO COUNTY—At 5 intersections in the City of Ontario, on "A" Street between San Antonio Avenue and Campus Avenue, traffic signal systems to be furnished and installed. District VIII, Route 26. Econolite Corp., Los Angeles, $23,991; C. D. Draucker Co., Los Angeles, $25,970. Contract awarded to Paul Gardner, Ontario, $23,829.25.

SAN BERNARDINO COUNTY—Between Etiwanda Avenue and Mulberry Avenue, about 1.0 mile to be graded and paved with Portland cement concrete, a reinforced concrete overhead crossing at Kaiser Spur and a steel beam span undercrossing at Kaiser Road to be constructed. District VIII, Route 26, Section D. Griffith Co., Los Angeles, $394,167; Winston Bros. Co., Los Angeles, $402,514; Peter Kiewit Sons Co., Arcadia, $410,928; J. E. Haddock, Ltd., Pasadena, $428,881; MacDonald and Kruse and Hensler Construction Corp., Glendale, $448,267; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $486,421; Dimmitt & Taylor, Los Angeles, $500,487; Guy F. Atkinson Co., Long Beach, $522,000; Matich Bros., Colton, $522,569. Contract awarded to George Herz & Co., San Bernardino, $377,203.60.

SAN BERNARDINO COUNTY—Between 0.9 mile north of San Bernardino city limits and Panorama Maintenance Station, a distance of about 6.7 miles to be resurfaced with plant-mixed surfacing. District VIII, Route 43, Section A. Matich Bros., Colton, $28,650; Griffith Co., Los Angeles, $32,451; Jesse S. Smith, Glendale, $34,128. Contract awarded to George Herz & Co., San Bernardino, $23,189.10.

SAN DIEGO COUNTY—In Del Mar, Solana Beach, Encinitas, Carlsbad, and El Cajon, furnishing and installing traffic actuated signal systems at six locations, furnishing and installing highway lighting at five of the locations and constructing curbs at three of the locations. District XI, Routes 2, 12, Sections AB, ECj. C. D. Draucker Co., Los Angeles, $72,850; California Electric Works, San Diego, $72,939. Contract awarded to Tri-Cities Electric Service, Oceanside, $53,845.

SAN LUIS OBISPO COUNTY—Between San Luis Obispo and Cuesta Grade, about 2.7 miles to be graded, asphalt concrete pavement to be placed on crusher run base and on existing pavement, and plant mixed surfacing to be placed on shoulders and other areas. District V, Route 2, Section D. Granite Construction Co., Watsonville, $784,197; A. Teichert & Son, Inc., Sacramento, $792,954. Contract awarded to Fredericksen & Kasler, Sacramento, $728,566.

SAN LUIS OBISPO COUNTY—Across Santa Rosa Creek about 9 miles east of Cam-

bria, a reinforced concrete slab bridge to be constructed. District V, Route 33, Section D. H. R. Breden, Compton, $19,735; O. R. Ochs & Son, San Luis Obispo, $20,930; Dinsmore & McCoy, Santa Barbara, $22,555; Grant L. Miner, Palo Alto, $24,876; Brown-Doko, Pismo Beach, $29,124; A. Madonna, San Luis Obispo, $30,591. Contract awarded to E. G. Perham, Los Angeles, $14,882.25.

SAN LUIS OBISPO COUNTY—Across Villa Creek, about one-half mile south of Pismo, a reinforced concrete slab bridge to be constructed. District V, Route 56, Section E. Dinsmore & McCoy, Santa Barbara, $29,129; Grant L. Miner, Palo Alto, $29,878; Brown-Doko, Pismo Beach, $31,869; O. R. Ochs & Son, San Luis Obispo, $37,006; Wheeler Construction Co., Oakland, $41,896; A. Madonna, San Luis Obispo, $49,870. Contract awarded to E. G. Perham, Los Angeles, $26,931.50.

SAN MATEO COUNTY—The superstructures for two overhead crossings over the tracks of the Southern Pacific Company (Main Line and Belt Line) in the city of South San Francisco, to be constructed. District IV, Route 68, Earl W. Heple, San Jose, $674,704; A. Soda & Son, Oakland, $675,695; Guy F. Atkinson Co., South San Francisco, $682,138; George Pollock Co., Sacramento, $694,348; Carrico & Gautier, San Francisco, $696,530; Leo Epp, San Francisco, $698,482; Chas. L. Harney, Inc., San Francisco, $698,-909; Peter Sorenson & Harry J. Oser, Redwood City, $699,757; Carl N. Swenson Co., Inc., San Jose, $704,447; M & K Corp., San Francisco, $739,914. Contract awarded to J. H. Pomeroy & Co., Inc., San Francisco, $640,207.

SAN MATEO COUNTY—On Canada Road, between 2.5 miles north of Woodside and Ralston Avenue, about 4.7 miles to be graded and surfaced with crusher run base and armor coat applied. District IV, FAS 1048, A. Teichert & Son, Inc., Sacramento, $254,712; N. M. Ball Sons, Berkeley, $257,-636; Westbrook & Pope, Sacramento, $281,239; Fredrickson Bros., Emeryville, $282,295; Piombo Construction Co., San Francisco, $286,936; Guy F. Atkinson Co., South San Francisco, $311,853; Louis Biasotti & Son, Stockton, $314,841; Morrison Knudsen Co., Inc., San Francisco, $316,925; Fredrickson & Watson Construction Co., Oakland, $326,245; Chas. L. Harney, Inc., San Francisco, $329,160; Peter Sorensen, Redwood City, $367,000; Eaton & Smith, San Francisco, $386,670. Contract awarded to Edward Keeble, San Jose, $235,857.

SANTA CRUZ AND SAN MATEO COUNTIES—Between Waddell Creek and Finney Creek, about 1.4 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 56, Sections C, A. Morrison-Knudsen Co. Inc., San Francisco, $541,914; A. Teichert & Son, Inc., Sacramento, $543,545; N. M. Ball Sons, Berkeley, $556,431; H. Earl Parker, Inc., Marysville, $573,203; L. A. & R. S. Crow, Los Angeles, $574,788; Fredericksen & Kasler, Sacramento, $582,749; George Pollock Co., Sacramento, $597,403; Guy F. Atkinson Company, South San Francisco, $644,346; Chas. L. Harney, Inc., San Francisco, $648,887; Fredrickson & Watson Construction Co., Oakland, $661,753; Fredrickson Bros., Emeryville, $671,973. Contract awarded to Eaton & Smith, San Francisco, $505,725.46.

SISKIYOU COUNTY—Between Fort Jones and 2.2 miles east of Moffett Creek, about 7.5 miles to be repaired with plant-mixed surfacing and shoulders to be constructed on portions of the project. District II, Route 82, Section D. Clements & Co., Hayward, $69,117. Contract awarded to Sheldon Oil Co., Suisun, $48,424.

SOLANO COUNTY—Furnishing and installing traffic signals in the city of Fairfield on Texas Street, at the intersection with Madison St., Weber Street and Union Avenue. District X, Route 7. L. H. Leonardi Electric Co., San Rafael, $16,350. Contract awarded to Ed. Pierce Electric Co., Vallejo, $8,075.

SOLANO COUNTY—Widening approach spans of bridge across Miner Slough about 12 miles north of Rio Vista. District X, Route 99, Section A. C. C. Gildersleeve, Marysville, $5,625. Contract awarded to Clifford M. Allen, Fairfield, $3,960.

STANISLAUS COUNTY — Furnishing and installing intersection illumination and traffic actuated signal system and constructing traffic islands in the city of Ceres. District X, Route 4. R. Goold & Son, Stockton, $13,999. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, $13,584.50.

STANISLAUS COUNTY—At Wildcat Creek, about 10 miles easterly of Oakdale, about 0.4 mile to be graded, surfaced with gravel, bituminous surface treatment applied and a double 168-inch field assembled plate culvert to be furnished and installed. District X, Route 13, Section B. H. Sykes, Patterson, $44,356; F. E. Young, Berkeley, $45,509; James E. Anderson, Visalia, $48,-428; A. G. Raisch Co. and Staring and Galbraith, San Francisco, $53,637; Beerman and Jones, Sonora, $56,278; Elmer J. Warner, Stockton, $61,643; M.J.B. Construction Co., Stockton, $62,172. Contract awarded to Biasotti Construction Company, Stockton, $43,291.

SANTA CRUZ COUNTY—On Green Valley Road between Freedom and Holohan Road, about 0.5 mile to be graded and surfaced with plant-mixed surfacing on crusher run base, and a reinforced concrete bridge to be constructed. District IV, Route 1146, A. Teichert & Son, Inc., Sacramento, $67,607; Dan Caputo & Edward Keeble, San Jose, $67,827. Contract awarded to Granite Construction Company, Watsonville, $60,936.50.

SHASTA AND SISKIYOU COUNTIES—Between Junction Route 3 and Diddy Hill and between Junction Route 3 and five miles north, a distance of about 22.1 miles, seal coat to be applied. District II, Routes 28 and 72, Sections A, A, W. C. Railing, Redwood City, $25,422; Harms Bros., Sacramento, $27,067; Sheldon Oil Co., Suisun, $28,725; J. Henry Harris, Berkeley, $35,341. Contract awarded to Morgan Construction Co., Pleasanton, $21,227.

TEHAMA, PLUMAS AND LASSEN COUNTIES—Between south boundary of Lassen National Park and Westwood, about 29.9 miles, seal coat to be applied. District II, Routes 83, 29, W. C. Railing, Redwood City, $39,552; Morgan Construction Co., Pleasanton, $40,500; J. Henry Harris, Berkeley, $43,021; Harms Bros., Sacramento, $43,993; Sheldon Oil Co., Suisun, $49,202. Contract awarded to Clements & Co., Hayward, $38,760.

TRINITY COUNTY—About two miles west of Douglas City, the existing timber trestle bridge across Redding Creek to be widened. District II, Route 35, Section C. E. G. Perham, Los Angeles, $19,679; S. C. Giles & Co., Stockton, $20,960; James H. McFarland, San Francisco, $23,748; O'Connor Bros., Red Bluff, $26,320. Contract awarded to C. C. Gildersleeve, Marysville, $16,236.

TRINITY COUNTY—Between Route 20 in Weaverville and Brown's Mountain about 6.3 miles to be graded and surfaced with crusher run base; and at East Weaver Creek, about 0.2 mile to be graded and surfaced with road-mixed surfacing on crusher run base and a reinforced concrete box culvert to be constructed. District II, Routes 1089 and 20, Section A. H. Earl Parker Inc. & Clements & Co., Marysville, $262,851; Westbrook & Pope, Sacramento, $267,821. Contract awarded to N. M. Ball Sons, Berkeley, $243,-345.40.

TULARE COUNTY—Across Kings River, approximately 5.5 miles west of Dinuba, a reinforced concrete girder bridge to be constructed. District VI, Route 1142, Trewhitt-Shields & Fisher, Fresno, $196,784; Dan Caputo, San Jose, $204,802; Bent Construction Co., Los Angeles, $213,082; E. H. Peterson & Son, Richmond, $226,536; C. B. Tuttle Co., Long Beach, $229,906; Butte Construction Co., San Francisco, $236,683. Contract awarded to Carl N. Swenson Co. Inc., San Jose, $194,700.

VENTURA COUNTY—On Pleasant Valley Road and Wood Road, between Ventura County Railroad and Ventura Blvd., about 6.5 miles to be surfaced with plant-mixed surfacing on existing surfacing and on imported borrow, and portions to be graded. District VII, Route 868, Jesse S. Smith, Glendale, $149,621; T. M. Page, Monrovia, $152,436; MacDonald & Kruse & Hensler Construction Corp., Glendale, $164,986; Silva & Hill Construction Co., Los Angeles, $168,522; J. E. Haddock, Ltd., Pasadena, $168,708; Griffith Co., Los Angeles, $176,413; Dimmitt & Taylor, Los Angeles, $179,086. Contract awarded to Frank T. Hickey, Inc., Los Angeles, $148,105.10.

YOLO COUNTY—Between 1.9 miles north of Solano County line and 1.6 miles south of Woodland and between 0.3 mile and 3.9 miles north of Woodland, a net length of about 4.9 miles to be repaired with plant-mixed surfacing and imported borrow to be placed on shoulders. District III, Routes 7, 87, Sections A,A. A. Teichert & Son, Inc., Sacramento, $48,295. Contract awarded to McGillivray Construction Co., Sacramento, $45,675.

YUBA COUNTY—Between Marysville and 0.4 mile south of Butte County line, about 9.6 miles to be repaired with plant-mixed surfacing. District III, Route 87, Section A. Contract awarded to Rice Bros., Marysville, $28,090.

July, 1947

AMADOR COUNTY—Between 3.7 miles easterly of Pine Grove and the North Fork of Mokelumne River, about 4.7 miles, to be graded and bituminous surface treatment applied. District X, Route 951, H. Earl Parker Inc., Marysville, $179,911; Johnston Rock Co. & Gordon L. Capps, Stockton, $183,963; Westbrook & Pope, Sacramento, $185,575; Claude C. Wood Co., Lodi, $213,735; Fredrickson & Watson Construction Co., Oakland, $227,254; Fredrickson Bros., Emeryville, $231,655; Piombo Construction Co., San Francisco, $237,000. Contract awarded to A. Teichert & Son, Inc., Sacramento, $177,915.70.

CALAVERAS COUNTY—Between State Highway Route 65 at San Andreas and Mountain Ranch, about 8.9 miles, to be graded and bituminous surface treatment to be applied to the central portion of the roadbed. District X, Route 952, J. E. Johnston, Stockton, $155,-518; H. Earl Parker, Inc., Marysville, $159,-735; A. Teichert & Son, Inc., Sacramento, $163,479; Dix-Syl Construction Co., Inc., Bakersfield, $163,522; Elmer J. Warner, Stockton, $168,271; Claude C. Wood Co., Lodi, $173,822; Piombo Construction Co., San Francisco, $215,234; Fredrickson Bros., Emeryville, $225,958. Contract awarded to Louis Biasotti & Son, Stockton, $155,073.

GLENN COUNTY—Between Willows and Athena, about 8.5 miles, a reinforced concrete slab span bridge to be constructed across Willow Creek, the existing asphalt concrete pavement on a portion of the project to be widened with gravel base, the remainder of the project to be graded and the entire project to be surfaced with gravel base and bituminous surface

treatment applied thereto. District III, Route 531, A. Teichert & Son, Inc., Sacramento, $122,977. Contract awarded to H. Earl Parker, Inc., Marysville, $121,951.85.

LASSEN COUNTY—Between Susanville and north side of Willow Creek Valley, about 17.6 miles, to be graded, imported borrow placed and a portion to be surfaced with road-mixed surfacing. District II, Route 988, Morrison-Knudsen Co. Inc., San Francisco, $348,313; H. Earl Parker, Inc., Marysville, $386,176; J. E. Haddock, Ltd., Pasadena, $567,798. Contract awarded to A. Teichert & Son, Inc., Sacramento, $283,421.

LOS ANGELES COUNTY—In the City of Los Angeles, on Santa Ana Parkway, between Aliso Street and Kearney Street, a total of about six acres to be prepared and trees, shrubs, ground cover and grass to be furnished and planted. District VII, Route 2, Crown City Nurseries, Pasadena, $11,749; Henry C. Soto & Co., San Pedro, $11,271. Contract awarded to Jannoch Nurseries, Altadena, $9,009.51.

LOS ANGELES COUNTY—On Arroyo Seco Parkway, between Bernard Street and Avenue 22, about 1.3 miles to be resurfaced with plant-mixed surfacing and portions to be widened with portland cement concrete pavement and plant-mixed surfacing on portland cement concrete base. District VII, Route 165, MacDonald & Kruse & Hensler Con. Corp., Glendale, $288,996; Dimmitt & Taylor, Los Angeles, $310,949. Contract awarded to J. E. Haddock, Ltd., Pasadena, $247,143.70.

LOS ANGELES COUNTY—Over Santa Clara River and the tracks of the Southern Pacific Company, about 18 miles east of Saugus, a structural steel girder bridge to be constructed. District VII, Route 830, W. J. Disteli, Los Angeles, $208,222; Carlo Bongiovanni, Los Angeles, $222,870; H. B. Nicholson, Pasadena, $226,740; Catalina Construction Co., Covina, $231,983; C. J. B. Construction Co., Oxnard, $236,710; Guy F. Atkinson Co., Long Beach, $247,427; Spencer Webb Co., Inglewood, $249,865; Byerts & Dunn, Los Angeles, $273,950; Dimmitt & Taylor & K. B. Nicholas, Los Angeles, $274,880. Contract awarded to Bent Construction Co., Los Angeles, $205,140.

MARIN COUNTY—Across Lagunitas Creek in Samuel P. Taylor State Park, a structural steel beam span bridge to be constructed. District IV, Bos Construction Company, Oakland, $24,769; Louis Bormolini & Son, Novato, $28,490; Minton & Kubon, San Francisco, $29,860; Grant L. Miner, Palo Alto, $31,144; Marin Corporation, Sausalito, $31,651; Parish Bros. and Lew Jones Construction Co., Benicia, $33,695. Contract awarded to W. Lenkeit Construction Co., San Francisco, $21,930.

NEVADA COUNTY—About one mile north of Polaris, the existing bridge across Truckee River to be repaired. District III, Route 38, Section A, Joe Chevreaux, Auburn, $16,465; Evans Construction Co., Berkeley, $16,785; H. W. Ruby, Sacramento, $16,839; C. C. Gildersleeve, Douglas City, $20,660; Barton & Anderson, Oakland, $21,171; Bos Construction Co., Oakland, $21,261; Grant L. Miner, Palo Alto, $21,986; Nevada Constructors, Inc., Reno, $28,820. Contract awarded to Litchfield Construction Co., San Rafael, $10,894.83.

RIVERSIDE COUNTY—On Jurupa Avenue between Mira Loma and Sunnyslope, about 5.3 miles to be graded and surfaced with plant-mixed surfacing. District VIII, Route 699, E. L. Yeager, Riverside, $110,576; Matich Bros., Colton, $113,031; Griffith Co., Los Angeles, $113,154; George Herz & Co., San Bernardino, $114,217; J. E. Haddock, Ltd., Pasadena, $111,427; Catalina Construction Co., Covina, $118,964; T. M. Page, Monrovia, $129,169; Dimmitt & Taylor, Los Angeles, $130,364. Contract awarded to Peter Kiewit Sons Co., Arcadia, $105,203.

SACRAMENTO COUNTY—Between Sutter Street in Folsom and 3.7 miles east of Folsom, about 4.2 miles, plant-mixed surfacing to be placed over existing pavement and imported borrow to be placed on shoulders. District III, Route 11, Section F-L, A. McGillivray Construction Co., Sacramento, $36,067; E. A. Forde, San Anselmo, $38,150. Contract awarded to A. Teichert & Son, Sacramento, $36,023.75.

SAN DIEGO COUNTY—Between the south city limits and the north city limits of Chula Vista, about 2.3 miles to be surfaced with plant-mixed surfacing. District XI, Route 2, Griffith Co., Los Angeles, $55,123; Basich Bros. Construction Co. and Basich Bros. Alhambra, $56,600; Daley Corp., San Diego, $56,635; V. R. Dennis Construction Co., San Diego, $56,771. Contract awarded to R. E. Hazard Contracting Co., San Diego, $48,690.25.

SAN DIEGO COUNTY—Between San Diego and El Cajon, about 2.9 miles to be resurfaced with plant-mixed surfacing. District XI, Route 12, Sections A, LMSa, B, ECj, R. E. Hazard Contracting Co., San Diego, $12,355; Basich Bros. Construction Co. & Basich Bros., Alhambra, $45,108; Daley Corporation, San Diego, $45,581; V. R. Dennis Construction Co., San Diego, $45,733. Contract awarded to Griffith Co., Los Angeles, $40,393.

SISKIYOU COUNTY—Between Thompson Creek and four miles east of Seiad, about 11.9 miles to be surfaced with road-mixed surfacing. District II, Route 46, Sections B, C, Sheldon Oil Co., Suisun, $74,117. Contract awarded to W. C. Railing, Redwood City, $58,931.

TULARE COUNTY—About 3.5 miles west of Porterville, a reinforced concrete slab bridge across Tule River to be constructed. District VI, Route 1128, Dan Caputo, San Jose, $131,955; Bent Construction Co., Los Angeles, $135,667; R. M. Price Co. & Rex B. Sawyer, Huntington Park, $148,425; A. R. Coffeen Co., Corona, $149,997; Granite Construction Co., Watsonville, $150,871; C. B. Tuttle Co., Long Beach, $152,385; Northup Construction Co., Long Beach, $164,122; E. H. Peterson & Son, Richmond, $174,085. Contract awarded to Trewhitt-Shields & Fisher, Fresno, $123,296.50.

TULARE COUNTY—Between two miles west of Woodville and Poplar, about eight miles to be widened and surfaced with plant-mixed surfacing on imported borrow base and bituminous surface treatment to be applied to shoulders. District VI, Routes 1129, 1130, Brown-Doko, Pismo Beach, $180,488; Griffith Co., Los Angeles, $187,461; A. Teichert & Son, Inc., Sacramento, $199,433; N. M. Ball Sons, Berkeley, $207,512. Contract awarded to F. Gunner Gramatky, Fresno, $175,412.

YOLO COUNTY—At west side of Yolo By Pass, about five miles east of Woodland, about 0.1 mile to be graded and bituminous surface treatment applied. District III, Route 50, Section E. R. A. Farish, San Francisco, $31,391; Jensen & Pitts, San Rafael, $34,708; H. Earl Parker, Inc., Marysville, $35,115; L. G. Lentz, Sacramento, $36,648; Harms Bros., Sacramento, $38,750; A. Teichert & Son, Inc., Sacramento, $43,822. Contract awarded to H. & D Construction Co., San Anselmo, $32,995.

VARIOUS LOCATIONS IN DISTRICT III—Seal coat to be applied to a net distance of about 41 miles. John C. Spaletta, Santa Rosa, $38,982; Fredericksen & Kasler, Sacramento, $39,380; Granite Construction Co., Watsonville, $41,970; J. Henry Harris, Berkeley, $46,814. Contract awarded to A. Teichert & Son, Inc., Sacramento, $37,677.75.

Prunedale Freeway Cut-off

(Continued from page 25)

mark to indicate to tourists that one of the famous old missions of California, Mission San Juan Bautista, is close at hand. This mission was founded by Fr. Presidente Fermin Francisco de Lasuen (as described in this magazine in the November-December issue of 1945).

Both units of the Prunedale Freeway Cut-off were constructed by Contractor A. Teichert and Son, Incorporated, of Sacramento. As Resident Engineer Mr. V. E. Pearson turned in a commendable job for the State.

Harbor Parkway Contract In Los Angeles Awarded

C. H. PURCELL, State Director of Public Works, on June 25 announced the award of a contract to James I. Barnes Construction Company, Santa Monica, for constructing the four-level grade separation structure at the intersection of Hollywood Parkway, Arroyo Seco Parkway, and Harbor Parkway, approximately three-quarters of a mile northwest of the Los Angeles City Hall. The contract price is $1,296,595.

Plans are practically complete for a grade separation structure at Temple and Harbor Parkway. This project's tie-up with the proposed Memorial Auditorium in the vicinity of Fifth and Figueroa Streets and the fact that it is the fourth arm of a beltline of freeways encircling the business district makes it of unusual interest to the citizens of Los Angeles. Generally, it will lie west of Fremont Street, the first section extending from Sunset Boulevard to Olympic Boulevard, passing just west of the Jonathan Club at Sixth Street and Figueroa, crossing Kip Street, Bixel Street, and intersecting Olympic in the vicinity of Georgia Street.

Because much of the traffic using these two routes desires an interchange from one parkway to another at this point, and, because the site of the intersection made it impracticable to adopt the usual cloverleaf or other type of interchange requiring a large amount of space in a horizontal plane, it was decided by engineers of the State Division of Highways, cooperating with the Los Angeles City Engineering Department, to expand in a vertical plane.



Thousands of vacationists and out-of-state tourists travel state highways to visit California's famed Mt. Shasta

State of California

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Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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DIVISION OF CONTRACTS AND RIGHTS OF WAY (LEGAL)

C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney

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SEPTEMBER - OCTOBER
1947

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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San Francisco-Oakland Bay Bridge Able to Finance a Second Span and Carry All Costs of Both Structures

BY COMBINING outstanding bonds of the San Francisco-Oakland Bay Bridge with a new bond issue for a second similar bay crossing, the present bridge revenues could finance another parallel bridge estimated to cost $100,000,000 and carry its interest and bond redemption costs even if earnings did not increase in the future.

Director of Public Works C. H. Purcell has so declared, basing his assertion on known and anticipated future traffic on the San Francisco-Oakland Bay Bridge, which cost, with approaches, $79,600,000.

During the fiscal year ended February 28, 1947, revenues of the bay bridge amounted to $7,981,000. Expenses, inclusive of bond maturities, totaled $3,248,341, leaving $4,732,659 in excess of fixed charges.

BONDS OUTSTANDING

Bridge bonds now outstanding aggregate $42,215,000. On September 1, $1,090,000 worth of bonds matured and were paid off, and an additional $2,417,000 of bonds were called and redeemed out of excess money now on hand.

This will leave $38,708,000 worth of bonds to be retired.

All outstanding bonds are callable on March 1, 1950. If no second bridge were contemplated, the present span could become toll-free early in 1953.

Purcell said that if the California Toll Bridge Authority desired to do so, it could safely, under a new revenue bond issue, sell enough bonds in 1949 to retire outstanding bonds of the existing bridge in 1950 and also finance a second bay crossing of design and location similar to the present one.

TRAFFIC STATISTICS

During the fiscal year ended June 30, 1947, a total of 25,511,724 vehicles used the bay bridge. Of this number 827,482 toll-free vehicles operated by federal agencies made use of passes.



Steady stream of revenue on San Francisco-Oakland Bay Bridge

Vehicular revenues totaled $7,528,841.41 for that period.

For the fiscal year ended June 30, 1947, rail and bus passengers numbered 27,574,928 and revenues accruing to the bridge from this traffic amounted to $547,247.44.

Since the opening of the bridge on November 12, 1936, to June 30, 1947, the total number of vehicles using the span was 182,875,557 and revenues from this source amounted to $59,294,276.19.

During the same period, there were 229,652,810 rail and bus passengers. The revenue from this source aggregated $5,447,631.65.

NEW BOND ISSUE $131,600,000

Purcell said that assuming that financing a second bridge costing $100,000,000 should be undertaken in 1949, the amount required to purchase the present bonds would be about $25,000,000, which, with the $6,600,000 that was borrowed from state highway funds to construct approaches to the present bay bridge, would make the total amount of bonds which would have to be issued $131,600,000.

Depending on the interest rate on the new bond issue it would require approximately from 22 to 26 years for debt retirement. At the end of any one of these periods, both the existing and the second bay bridge would become toll-free without any financial assistance from the new span.

If additional traffic is induced by reason of expanded transbay transportation facilities, the period of time required to retire a new bond issue would be reduced accordingly.

The San Francisco-Oakland Bay Bridge was originally financed by the sale of revenue bonds in the total amount of $73,000,000 to the Reconstruction Finance Corporation. In addition, an allocation of $6,600,000 was granted from the State Highway Fund to be used for bridge approaches, subject to the requirement that after the redemption of all revenue bonds this amount would be refunded to the Highway Fund out of toll collections.

In 1939 a refinancing was effected and a new issue of 4 percent bonds, in principal amount of $71,000,000 was sold to a syndicate of investment houses. The specified redemption date of the last of these bonds was 1976. As of March 1, 1944, the California Toll Bridge Authority had outstanding $57,070,000 of these bonds subject to call and redemption as a whole on March 1, 1945.

On May 5, 1944, the California Toll Bridge Authority adopted a resolution authorizing the creation of an issue of not exceeding $60,000,000 principal amount of San Francisco-Oakland Bay Bridge Toll Bridge Revenue Bonds. On May 22, 1944, the authority, after due notice, sold $65,000,000 principal amount of the bonds, due September 1, 1962, at an average interest rate to maturity of 1.96613 percent, effecting a saving of $5,097,000 in interest cost.

California Highway Commission Add

THE CALIFORNIA Highway Commission, at its August meeting in San Francisco, added 17 million dollars to its 1947-48 Fiscal Year construction program from a portion of the increased revenues created by the Collier-Burns Highway Act. This 17 million represents the total amount of new money available for construction, construction engineering, and right of way acquisition. The Collier-Burns Highway Act does not become fully operative insofar as all additional new funds are concerned until January 1, 1948.

Director of Public Works Charles H. Purcell, Chairman of the Commission, stated that the Commissioners, in selecting critical deficiency projects to be financed from funds provided by the last Legislature, had to take into consideration that construction costs have increased an average of 60 percent; that necessary right of way expenditures for the current fiscal year have risen 8 million dollars; and that there has been an increase of from 12 to 16 million in maintenance costs.

The previous budget for the Fiscal Year July 1, 1947, to June 30, 1948, approved by the Highway Commission on November 20, 1946, provided for 34 million for construction (including major and minor projects), construction engineering, and right of way; to this the Commission added 17 million dollars.

This 17 million dollars represents all of the new money made available by the Collier-Burns Highway Act for construction purposes for this fiscal year. Total projects authorized in the south county group are estimated to cost 27 million for construction, construction engineering, and right of way; and projects authorized in the north county group are estimated to cost 24 million. A number of these projects have been advertised and the balance will be placed under way by June 30, 1948.

The next budget of the Highway Commission for 1948-49 must be submitted to the Governor 30 days prior to the next budget session of the Legislature, which will convene on the first Monday of next March. Purcell said that the Division of Highways has and will have plans completed so that advertising for bids on projects in the 1948-49 Budget will, as authorized by law, begin on March 1st and the awarding of contracts will start on April 1st.

The construction projects in the budget from July 1, 1947, to June 30, 1948, are shown on the following tabulation:

County	Route	Description	Approximate mileage	Estimated cost, including engineering and right of way
Alameda	(US50)	Redwood Road, signals and channelization		45,000
Alameda	(SR17)	East Shore Freeway in Oakland, at Fruitvale Avenue, superstructure for grade separation		1,100,000
Fresno*	(US99)	South County Boundary to Selma, grade, pave, and structures	4 7	853,000
Fresno	(US99)	In Fresno, intersections of Broadway and Divisadero, H Street and Divisadero, H Street and Belmont, traffic signals		6,000
Glenn*	(SR45)	Sacramento River near Butte City, bridge superstructure		300,000
Humboldt	(SR96)	Klamath River at Weitchpec, bridge superstructure and approaches	0 6	435,000
Humboldt	State Park	Whittemore Grove State Park, South Fork of Eel River at Redway, bridge		63,000
Imperial	(US80)	Apache Wash and Sandy Ditch, redeck bridges		35,000
Imperial*	(US99)	Trifolium Canal to two miles north of Sandy Beach Road, grade, pave, and structures	15 2	587,000
Imperial	(US80)	Grays Well to State Line, redeck and widen twelve timber bridges		73,000
Imperial	(SR98)	New River and Greeson Wash, bridges and approaches	0 3	110,000
Inyo	(US6) (US395)	Alabama Gates Spillway to Manzanar, grade and surface	4 4	256,000
Inyo	(US6) (US395)	10.7 miles south of Olancha to 2 miles south of Olancha, drainage correction	8 7	19,000
Inyo	(SR127)	Near Shoshone, grade and surface	1 0	15,000
Kern	(US99)	In Bakersfield, intersection of Baker Street and Niles Street, traffic signals		2,500
Kern	(US466)	Keene to Tehachapi, bridge superstructures		475,000
Kern	(US466)	Walker Basin, redeck bridges		25,000
Kern	(US466)	Caliente Creek, redeck bridge		14,000
Kern	(SR178)	Main Drainage Canal, bridge and approaches		23,000
Kern	(US466)	Near Monolith, reconstruct railroad crossing	0 2	19,000
Kern	(SR65)	Poso Creek, extend, redeck, and repair bridge		17,000
Lake	(SR53)	Coyote Creek, bridge and approaches		96,000
Lake	(SR53)	Burns Valley Creek, bridge		12,000
Los Angeles*	(US101)	Alameda Street to Vermont Avenue (portions) structures and grading		3,000,000
Los Angeles	(US101)	Soto Street to Eastman Street, grade and pave	2 0	2,000,000
Los Angeles*	(US101)	Calabasas to 1.5 miles westerly, grade, pave, and structures	2 2	633,000
Los Angeles	(US101)	Whittier Boulevard and Durfee Road, traffic signals		16,000
Los Angeles	(US101)	Whittier Boulevard, Painter Avenue to Redman Avenue, traffic signals and channelization		45,000
Los Angeles	(US99)	Violin Saddle to Whitaker Summit, grade, pave, and structures	4 5	1,960,000
Los Angeles	(US66)	Intersections Falling Leaf Avenue and Buena Vista Avenue; Foothill Boulevard and Irwindale and Alosta Avenues; Alosta Avenue and Grand and Citrus Avenues, traffic signals		100,000
Los Angeles	(US66)	Alosta Avenue and Glendora Avenue, traffic signals		16,000
Los Angeles	(US66)	In Monrovia, Foothill Boulevard and Fifth and Myrtle Avenues, traffic signals		12,000
Los Angeles	(US60)	Garvey Avenue at Valley Boulevard, additional traffic signals and channelization		24,000

17,000,000 to Construction Budget

County	Route	Description	Approximate mileage	Estimated cost, including engineering and right of way
Los Angeles	SR138	Sandy Creek, bridge		10,000
Los Angeles	SR138	Stony Wash, bridge		10,000
Los Angeles	SR138	Big Rock Wash, two bridges		40,000
Los Angeles	US101	Lincoln Boulevard at Jefferson Boulevard, traffic signals		17,000
Los Angeles*	SR2	Angeles Crest Highway (portions), grade and surface (prison labor)		400,000
Los Angeles	77	Valley Boulevard, east city limits of San Gabriel to Garvey Avenue (except City of El Monte and Peck Road), traffic signals		65,000
Los Angeles	SR7	Sepulveda Boulevard and Jefferson Boulevard (North), traffic signals and channelization		39,000
Los Angeles	SR7	Sepulveda Boulevard and Jefferson Boulevard (South), traffic signals and channelization		39,000
Los Angeles	SR7	Sepulveda Boulevard and Centinela Avenue, traffic signals and channelization		34,000
Los Angeles	SR107	Hawthorne Boulevard, 167th Street to Imperial Highway, traffic signals and channelization		93,000
Los Angeles	SR107	Hawthorne Boulevard and Redondo Beach Boulevard, traffic signals		19,000
Los Angeles*	US6	Adobe Street to Fifth Street (portions), grade, pave, and structures	1 2	800,000
Los Angeles	US6	Figueroa Street and Carson Street, traffic signals and channelization		16,000
Los Angeles	SR15	Atlantic Avenue and Rosecrans Avenue, traffic signals and channelization		17,000
Los Angeles	SR15	Atlantic Avenue between Washington Street and Anaheim-Telegraph Road, traffic signals		13,000
Los Angeles	SR19	Lakewood Boulevard and Flower Street, traffic signals		17,000
Los Angeles	SR19	Rosemead Boulevard and Mission Drive, traffic signals and channelization		17,000
Los Angeles	SR19	Rosemead Boulevard and Las Tunas Drive, traffic signals and channelization		19,000
Los Angeles	SR19	Rosemead Boulevard and Huntington Drive, traffic signals and channelization		20,000
Los Angeles	SR35	Stafford Creek, bridge		10,000
Los Angeles	SR26	Olympic Boulevard between Lincoln Boulevard and Bundy Drive, grade and pave	2 3	1,521,000
Los Angeles	SR26	Olympic Boulevard, Indiana Street to Anaheim-Telegraph Road, traffic signals		40,000
Madera	US99	San Joaquin River to Arcola School grade and pave	7 2	1,340,000
Madera	US99	In Madera, intersections of 4th Street and 6th Street, traffic signals (State's share, portion City funds)		5,000
Marin	US101	At Greenbrae, traffic signals and channelization		50,000
Mendocino*	US101	Rock Creek, bridge and approaches	0 6	192,000
Mendocino	SR28	Rancheria Creek, redeck bridge		6,000
Mendocino*	SR1	Navarro River, bridge and approaches	0 7	439,000
Merced	US99	In Merced, traffic signals		7,000
Modoc*	US395	Route 28 to Oregon State Line (portions), grade and surface (prison labor)	7 8	275,000
Nevada	SR49	1.5 mile north of Rattlesnake Creek to Grass Valley, grade and surface	3 8	517,000
Nevada	US40	Kingvale & Donner Grades, grade & surf.	3 0	105,000 7(s)
Nevada	US40	Flycasters Curve, grade and surface	1 0	85,000
Orange	US101	In San Clemente, south city limits to Valencia Street, grade and pave	1 8	144,000
Orange	US101	In Anaheim, Los Angeles Street, traffic signals		46,000
Orange	US101	Spadra Road and Orangethrope, traffic signals		17,000
Orange	SR55	Newport Avenue and Harbor Boulevard, traffic signals		17,000
Orange	SR55	In Orange, Tustin Avenue and Chapman Avenue, traffic signals		17,000
Orange	US101	Corona Del Mar to Route 171, traffic signals		118,000
Orange	US101	Broadway Intersection in Sunset Beach, traffic signals		17,000
Orange	SR39	Stanton Avenue and Lincoln Avenue, traffic signals		21,000
Orange	SR18	In Anaheim, Center Street, traffic signals		12,000
Orange	SR22	Garden Grove Boulevard and Harbor Boulevard, traffic signals		17,000
Orange	183	Bolsa Avenue and Harbor Boulevard, traffic signals		17,000
Riverside	US99	Banning to White Water, redeck timber bridges		56,000
Riverside	US60	4 miles west of Blythe to State Line, grade, surface and structures	7 7	384,000
Riverside	US60	Deep Canyon Wash, redeck bridge		17,000
Riverside* San Diego	US395	Escondido to 10 miles north of San Diego County Line (portions), grade and surface (prison labor)	6 ±	380,000
Riverside	SR111	Whitewater Point to 0.5 mile north of Palm Springs, grade, surface and structures	4 1	632,000
Sacramento	US40	North Sacramento Viaduct to 0.5 mile east of Ben Ali, lighting and landscaping		69,000
Sacramento	US99	Stockton Boulevard and 14th Avenue, widening and traffic signals		20,000
Sacramento	SR24	Three Mile Slough, bridge superstructure and approaches		672,000
San Bernardino*	US60	Los Angeles County Line to 6.0 mile east of Ontario, grade, pave and structures	5 8	1,064,000
San Bernardino	US466 (US66)	Various locations, redeck timber bridges		56,000
San Bernardino	US66	In Upland, Junction Routes 9 and 192, traffic signals and channelization		26,000
San Bernardino*	207	City Creek to 0.7 mile east of Plunge Creek, grade, pave and structures	4 3	1,010,000
San Diego	US101	In Oceanside, 3rd and Hill Streets, traffic signals		13,000
San Diego	US80	In San Diego, Texas Street and Rolando Boulevard, traffic signals		25,000
San Diego*	US395	Escondido to County Line, surfacing	23 5	312,000
San Diego* Riverside	US395	Escondido to 10 miles north of San Diego County Line (portions), grade and surface (prison labor)	6 ±	380,000
San Diego	SR79	Line change at mile 3.1 to mile 4.3, grade and surface	1 2	13,000

County	Route	Description	Approximate mileage	Estimated cost, including engineering and right of way
San Diego	(SR79)	Agua Caliente and Buena Vista Creek, bridge and approaches	0.2	100,000
San Diego	195	Colby Ranch to Rincon Store, grade and surface	0.5	30,000
San Diego	(SR78)	In El Cajon, Wright Street Creek, bridge		6,000
San Diego	(SR78)	San Felipe Creek (Sentenac), bridge and approaches	0.3	80,000
San Diego	(SR75)	National and Palm, Palm City, traffic signals		11,000
San Diego	(SR49)	In San Diego, Euclid and Federal, traffic signals		13,000
San Joaquin	(US99) (US50)	Junction Mariposa Road south of Stockton to Calaveras River, and Wilson Way to Route 4, grade and structures	8.5	2,093,000
San Joaquin	(US50)	San Joaquin River, bridge superstructure and approaches		550,000
San Joaquin	(US50)	In Tracy, traffic signals		7,000
San Luis Obispo	(US101)	Miles Station to March Street in San Luis Obispo, grade, pave and structures	6.3	1,990,000
San Mateo	(US101)	Junipero Serra connection, traffic signals and channelization		23,000
San Mateo	(US101)	Lomita Park, traffic signals		20,000
San Mateo	(SR1)	White House Creek, culvert		23,000
San Mateo	(SR1)	Gazos Creek, bridge		17,000
San Mateo*	(US101)	Bayshore Freeway, North City Limits of South San Francisco to 0.35 mile south of Colma Creek, grade, pave and structures	2.0	2,075,000
San Mateo	(US101)	Bayshore Freeway Colma Creek in South San Francisco to Broadway in Burlingame, superstructures, approaches and landscaping	5.1	1,606,000
San Mateo	(US101)	Willow Road, traffic signals and channelization		8,000
Santa Barbara*	(US101)	Park Place to Rancheria Street, Salsipuedes Overhead, superstructure and landscaping	2.3	816,000
Santa Barbara*	(US101)	Santa Ynez River to Jonata Park, structures		860,000
Santa Clara	(US101)	Sunnyvale, junction Route 114, traffic signals and channelization		130,000
Santa Clara	(US101)	Castro Street (Mountain View), traffic signals and channelization		85,000
Santa Clara	(US101)	San Antonio Road, traffic signals and channelization		45,000
Santa Clara	(US101)	Agnew Road, traffic signals and channelization		12,000
Santa Cruz*	(SR1)	Rob Roy to Morrissey Avenue in Santa Cruz, grade and structures	7.7	2,487,000
Shasta	(US99)	In Redding, Intersection Routes 3 and 20, channelization		7,000
Shasta	(SR44)	At Redding, Route 3 to 1.5 miles east of Sacramento River Bridge, superstructure and approaches	1.5	721,000
Shasta	(US299)	Tower House to Shilling, grade and surface	5.3	785,000
Siskiyou*	(US99)	Camp Lowe to Bailey Hill, grade	7.8	942,000
Solano*	(US40)	Vallejo Wye to north of junction of Route 208, grade, pave, and structures	5.4	1,900,000
Sonoma	(SR48)	Tolay Creek, redeck bridge		9,000
Sutter	(US99)	Live Oak Line change, grade and surface	1.7	214,000
Sutter—Yuba	(US99)	In Marysville and Yuba City, Feather River Bridge and approaches, landscaping, lighting, and signals		175,000
Sutter	(SR24)	Sutter Causeway, redeck bridge (portions)		20,000
Trinity*	(US299)	Willow Creek to White's Bar (portions), grade and surface (prison labor)	.4	265,000
Tulare*	(US99)	0.5 mile south of County Line to County Line, grade and pave	0.5	88,000
Tuolumne*	(SR120)	Tuolumne River at Stevens Bar, bridge and approaches (portion County funds)	0.1	205,000
Ventura	(US101)	0.5 mile west of El Rio to Santa Clara River Bridge, grade, pave, and signals		300,000
Ventura	(US399)	In Ventura, resurface existing pavement		17,000
Yuba—Sutter	(US99)	In Marysville and Yuba City, Feather River Bridge and approaches, landscaping, lighting, and signals		175,000

Highway Links Aid Grand National Traffic

SPONSORS of the 1-A District Agricultural Association are eagerly studying recent construction plans for new San Francisco highway links to the projected Bayshore Freeway south of the city.

Their expectation is that the operations will facilitate traffic to San Francisco's Cow Palace and the annual Grand National Livestock Exposition, heralded as one of the country's "Big Six" premier livestock shows.

It is expected that the hundreds of motorists who will drive in to San Francisco from points north, east, south and west, expressly to see the Grand National this year from November 1 through November 9, will continue to beat their path over main state highways that are being readied for the event.

For, again this year, the Grand National will attract both city and country dwellers to its livestock, rodeo and horse show that is without parallel in the country.

Opening in the Cow Palace on November 1, the Grand National promises nine days of entertainment in addition to its entries of the continent's finest beef and dairy cattle, sheep and swine. There will be a national horse show with $25,000 prizes at stake; a rodeo of champions fighting it out for titles and almost $30,000 in purses and circus and tanbark acts.

The vast arena spectacle, which plays to an audience of some 12,000 at a time, is scheduled to take place thirteen times during the Exposition—every night at 8 and four afternoons, November 1, 2, 8 and 9 at 2 p.m.

Here is reason indeed for an autumnal trek westward over California highways to the Cow Palace and Exposition . . . reason too, for constant public interest in the State's great highway improvement program.

Colorful Ceremonies Mark Dedication Of New Four-Lane Marin-Sonoma Highway

CEREMONIES commemorating completion of the San Rafael-Novato-Petaluma sector of U. S. 101 in Marin and Sonoma Counties were staged by the Redwood Empire Association at Novato on Friday morning, August 22d.

Officials of the Department of Public Works, Division of Highways, California Highway Commission, boards of supervisors of Marin and Sonoma Counties, Golden Gate Bridge and Highway District, chambers of commerce of San Rafael, Novato, and Petaluma, mayors and city councilmen of Petaluma and San Rafael, the associated chambers of commerce of Marin and Sonoma Counties, the Marin County Junior Chamber of Commerce, federal officials and members of the State Legislature, participated in the colorful celebration.

Director of Public Works C. H. Purcell, who is Chairman of the Highway Commission, represented Governor Earl Warren, who was prevented from attending by other official business.



Director of Public Works C. H. Purcell starts flow of traffic over new Marin-Sonoma highway, while Patricia Allen, Patricia Ceresa, and Catherine De La Montanya look on approvingly

CONTROLLED ACCESS FREEWAY

The new project, a controlled access freeway to which was allocated $1,700,000 from California's post-war highway construction program, stretches from South Third Street in Petaluma, 12 miles southerly to Ignacio Wye. It makes full use of the previously constructed two-lane, 20-foot concrete highway which is now paralleled by the newly completed 23-foot wide Portland cement, concrete pavement. Each of these roads carries traffic in only one direction. They are separated by a landscaped, 39-foot safety dividing strip.

Several engineering difficulties required special attention before completion of this new facility. Special subgrade treatment was necessary on marsh land sections. Particular attention was given throughout the project's length to control of slope erosion by landscaping. Two major concrete reinforced girder bridges were required, one over Novato Creek and the other across San Antonio Creek. These bridges provide a 27-foot wide, clear roadway for traffic in one direction. They are supplemented by many minor drainage structures along the 12-mile section. Modern alignment provides high standard sight distance throughout, and full advantage is taken of scenic resources along the route.

CEREMONIES AT NOVATO

Much work such as right of way fencing, stock crossing, relocation of public utilities and numerous building setbacks on relocations were incidental to the contract.

Ultimately, a three-foot width pavement will be added to the high standard, 20-foot strip last improved in 1939.

An accelerated highway building program will make possible additional such projects in all sections of the State.

The dedicatory ceremonies were opened by George C. Hoberg of Lake County, President of the Redwood Empire Association, who introduced Marin Vice President Clifford Bartlett, who acted as master of ceremonies. Following the introduction of prominent guests, including Director Matt Graham, Golden Gate Bridge and Highway District; State Senator Thomas F. Keating of Marin County; Assemblyman Richard H. McCollister of Marin and Sonoma Counties; Supervisor Fred Bagshaw, Marin County; Supervisor George Kennedy, Sonoma County; Supervisor Pat McMurray of San Francisco; Mayor Robert Austin, San Rafael; Mayor Jasper S. Woodson, Petaluma; Harold Eckart, President Petaluma Chamber of Commerce; M. J. Lamperti, President San Rafael Chamber of Commerce; Richard Smiley, President Marin County Junior Chamber of Commerce; Ward Von Tillo, President Associated Chambers of Commerce of Sonoma; A. W. Bowman, President Novato Chamber of Commerce; C. N. Strawn, U. S. Forest Service; Col. Jno. H. Skeggs, District Highway Engineer, who supervised the project; members of the Highway

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Widening of U. S. 99 in Bakersfield To Six Lanes Will Reduce Traffic Accidents

By T. E. WHALEY, Associate Highway Engineer

THE MANY motorists who travel the Golden State Highway in the southern San Joaquin Valley can now enjoy the modern six-lane highway through the formerly congested portion passing through the City of Bakersfield.

Bakersfield, which has had a very rapid growth, is a well-known origin, destination, and stopping point for the large volume of traffic in this area.

The petroleum industry has for many years generated much commercial traffic in this area, but agriculture has in the last few years equaled or surpassed the oil industry with an attendant increase in the heavy commercial type of traffic.

The usual increase in commercial traffic, the large general state-wide gain in automobile traffic and the large increase in local city traffic, which must use or cross the Golden State Highway, produced a bottleneck of a serious nature. This was not only annoying to both the through motorist and the local motorist, but was the cause of many accidents.

HIGH ACCIDENT RATE

During the year 1941, there were 175 reported traffic accidents within the 1.9 mile length of this project. There were 98 accidents concentrated in a distance of four city blocks; 47 occurring at 18th Street, 26 at 19th Street and 25 at 21st Street.

As a result of the large increase in traffic load, especially heavy trucks and trailers, the old four-lane pavement was progressively failing to the point where maintenance was very expensive.

These three major factors, safety, lack of capacity, and structural fail-

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On opposite page—Upper—Looking northerly on Union Avenue from Eighth Street. Center—Looking northerly on Union Avenue from Eureka Street with 18th and 19th Street intersections. Lower—Looking southerly on Union Avenue from 21st Street

Looking northerly on Union Avenue from near Brundage Lane in Bakersfield




SAFEWAY
TINY'S
QUALITY FOOD
MARKET SPOT

Highway Engineers Must Have Help of Motorists in Combating Accident Rate

On August 15th, last, Mr. L. H. Batman, publisher of "The Township Register," Niles, California, printed on the front page of his newspaper an open letter to State Highway Engineer George T. McCoy. He called attention to a fatal traffic accident which had occurred at the intersection of State Highway Routes 5 and 107—the Hayward-Mission San Jose and Niles Canyon roads—and in boldface type said: "Adequate warning devices must be installed at this dangerous intersection."

California Highways and Public Works, believing that Mr. McCoy's reply to Mr. Batman will be of interest to all newspaper publishers as well as to all motorists, prints it in full.—Ed.

September 5, 1947

MR. L. H. BATMAN, *Publisher*
The Township Register
Niles, California

DEAR MR. BATMAN: Your open letter to me, which appeared in the August 15 edition of your widely read *The Township Register,* charging that the Division of Highways has not installed adequate warning devices at the intersection of Highway 17 and the Niles Canyon Road has, of course, come to my personal attention.

Let us consider specifically the situation at the intersection of State Highway Routes 5 and 107 (Hayward-Mission San Jose and Niles Canyon Roads) which was the immediate occasion for your letter.

By the use of bold face capital type you emphasize the statement: "Adequate warning devices must be installed at this dangerous intersection." I have before me a detailed report of an investigation of this location which includes scale drawings and photographs of the area. These show that uniform "Stop" signs are in place on Route 107 and on the county road approaching from the west. Traffic stripes are in place and stop bars and the word "Stop" in large letters are painted on the pavement. Cross Road warning signs are in place in both directions on Route 5 in advance of the intersection and the intersection is lighted at night by two luminaries. There is good visibility distance in each direction on all legs. In view of these facts I am somewhat puzzled that the adequacy of the control devices installed at this intersection should be questioned, since they fully equal and indeed exceed recognized satisfactory control treatment for intersections of this type. Surely no one licensed to drive and exercising even the most rudimentary prudence could advance a claim that lack of adequate control devices caused him to become involved in an accident at this point.



This photograph, looking east from the west leg at intersection of Hayward-Mission San Jose and Niles Canyon Roads, shows "STOP" signs and "CROSS ROAD" warning signs. There is good visibility in each direction on all legs

DRIVERS AT FAULT

In the particular accident to which attention is drawn in your letter your own news account states (and this is fully confirmed by the record) that: "* * * the death car was coming at a very fast rate (the reports says 60 miles per hour) of speed out of Niles Canyon when it failed to stop and ran into the truck trailer." This was on a clear summer day shortly after 12 o'clock noon. Any tragic occurrence such as this is of course always greatly to be regretted, but there can be no escape from the hard fact that no preventive measures whatsoever can be effective which do not also include reasonable cooperative action on the part of the driver.

Setting aside this single accident as an isolated case, we have also reviewed the record of all other accidents which have been reported as occurring at this intersection since January 1, 1945. This study reveals no evidence that inadequacy of traffic control devices could be cited as having in any sense contributed materially to the 15 accidents reported.

In seven cases the drivers at fault admitted that they were frequent

users of the intersection and consequently they may be presumed to have been fully aware of the physical conditions. Three cases involved two drivers and one pedestrian who were either drunk or had been drinking.

THE HUMAN ELEMENT

In two cases, both in daylight, the drivers stopped at the "Stop" sign and then for some undetermined reason drove out into the intersection into the path of a passing vehicle.

In one case a northbound car, in daylight, on Route 5 (Hayward-Mission San Jose main highway) turned left directly in front of a southbound car on the same highway. The report in one case is not clear as to whether or not the driver observed the boulevard stop. He was injured and had no remembrance of what he did. His statement that he had never previously used the intersection is difficult to accept in view of the other data showing that he is a resident of Hayward and has had 21 years of driving experience.

In the only remaining case, which also involved disregard of boulevard stop, there is no evidence in the record to question the driver's statement that he had never before used the road. However, he holds a California driver's license and claims 19 years of driving experience. With no extenuating circumstances present such as inclement weather, mechanical defects, or outside distracting elements, there is no reason to believe that a driver so unobservant as he would have acted any differently no matter what control devices may have been present.

ENGINEERS DO THEIR BEST

We of the Division of Highways whose chore it is to design, construct, and maintain state highways throughout the State are perhaps more acutely and more constantly aware of the gravity of this problem than those of other groups. We frankly recognize that this division is charged with certain and important responsibilities in highway transportation activities. These we accept without question and endeavor to the full extent of our ability and authority to meet them honestly and intelligently. But to assume more or to permit ourselves to be presented as being responsible for things clearly beyond our power to control would be a distinct disservice to everyone.

It is the function of the highway engineer to provide and maintain—within the limits of the funds at his disposal—facilities which if properly used will assure the expeditious and safe movement of traffic. This is our constant objective. Save to the most limited degree there can be no positive physical guarantee against misuse. However, the engineer in common with all good workmen is deeply interested and concerned that the thing he fashions will in actual use function as it inherently can and would if intelligently used. To this end we endeavor, in addition to providing those elements which are basically essential, also to incorporate all reasonable features which will assist and induce proper action on the part of the ordinary user. Among students of the problem and among all thoughtful people, and based both upon factual records and general observation, it is accepted beyond question that the overwhelmingly preponderant majority of traffic accidents are the result of personal failure in some manner on the part of the vehicle driver, or of the pedestrian himself where a pedestrian is involved.

CARELESS USE OF ROADS

To cope with this condition there is not much the engineer can do beyond those things we have noted above. And that is not enough. And knowing that it is not enough we cannot be satisfied so long as we are daily made aware that the inherent value of these highways which are our particular concern is not only not being achieved but is constantly being destroyed, primarily by unthoughtful if not plainly careless use.

Realization of this fact is why I am most happy for the opportunity which your letter affords to call upon you for help in this our common problem.

The people of California through legislative processes provide for the issuance of individual operator's licenses. Such licenses are issued only after a demonstration of familiarity with the California Vehicle Code as well as a knowledge of devices used upon highways for controlling traffic. The operator's license is not only a permit to operate an automobile on California's highways, but it also entails an obligation that such operation shall conform to law, to the rules of the road, and to the obligations generally imposed upon citizens of the State. These conditions are equally true as regards the visitors from outside our boundaries, since signs, signals, markings, and rules of the road have now become in all essential features practically uniform throughou' the country.

FACE-SAVING EXPLANATIONS

The records of the Department of Motor Vehicles show for the last calendar year (1946) that in 62,893 (roughly 90 percent) of the total of 70,087 accidents reported in which death or injury was involved, one or more of the drivers had violated provisions of the California Vehicle Code. And the fact that in the other 10 percent of the cases no violation was reported is by no means conclusive that none was committed.

We are too apt to accept irresponsible statements and inferences to the effect that these accidents are for the most part attributable to the so-called "accident prone" drivers who are repeatedly involved in trouble. This too ready agreement in such a face-saving explanation in which the great majority of us indulge is not only indefensible from the standpoint of fact but is in itself one of the most serious contributory reasons for the existing deplorable accident situation. While it is doubtless true that there are here and there scattered instances of drivers who have been involved in two or three, or in very rare cases even more than three, accidents within a comparatively short space of time, the total of all of these is but a tiny fraction of the thousands of accidents which yearly occur on our streets and highways. The cold blunt fact of the matter is that this scandalous yearly total of traffic accidents is made up of single occurrences involving John Jones, who in all likelihood has never had an accident before or who at least has driven tens of thousands of miles since his last previous mishap.

UP TO INDIVIDUAL

Not until the ordinary user of our highways can be reached and thoroughly imbued with the realization of his own constant, never-ending individual responsibility for proper use of the public highway can we hope for any appreciable improvement in the record.

It is here, Mr. Batman, where you and your colleagues can be of incalculable assistance. The power of the press is axiomatic. And the influence of the local press is of especial value in this matter, for the great bulk of accidents are local. They involve local people on our local streets and roads. Our records of accidents occurring on state

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Constructing fill above main line of Southern Pacific tracks near Cable

New Highway—Keene to Tehachapi

By J. W. COLE, Associate Highway Engineer

THE MOTORING public will welcome the completion of a section of new highway between Keene and Tehachapi in Kern County which will replace an old highway that is steep, narrow and crooked, built about the year 1916.

The new highway is 10.45 miles in length compared to 13.80 miles on the old highway. Its alignment and grades are unusually good for mountainous country. The location is on a southerly exposure and several hundred feet lower than the old road, and the snow problems should correspondingly decrease.

The recent work has been done by the Guy F. Atkinson Company and completed six months ahead of the contract completion date. The work is a continuation of a project begun by prison labor in June, 1937 at the Bear Mountain Ranch and carried on until 1943 when the prison camp was closed down. A description of that work appeared in the January, 1940 number of the California Highways and Public Works magazine. The total length of the project completed, Bear Mountain Ranch to Tehachapi, is 15.00 miles.

GRADING OPERATIONS

The contractor made rapid progress on roadway excavation. The peak output was 11,000 cubic yards per day. To accomplish this three 2½ cubic yard shovels, 6 Tournapuls and 6 carryalls, also 15 bulldozers were used. About one-third of the excavation was rock that required blasting.

BRIDGES AND CULVERTS

The contract included the substructures of four bridges and a small concrete bridge complete, a concrete arch 262 feet in length and 30 square feet flow area, and two double box concrete culverts.

Bridge 50-44 located near Keene is 375 feet in length and carries the roadway over the Southern Pacific Railroad and Tehachapi Creek.

Bridge 50-171 located near Cable is 292.7 feet in length and spans Tehachapi Creek.

Bridge 50-172 located near Cable is 96 feet in length and spans Tehachapi Creek.

Bridge 50-173 is 23 feet in length and spans a tributary of Tehachapi Creek and is located near Cable.

Bridge 50-149 located near Tehachapi is 465 feet in length and carries the roadway over the Southern Pacific Railroad and Tehachapi Creek. The total length of bridges is 1,252 feet.

The Guy F. Atkinson Company has recently been awarded the contract for the completion of the bridge superstructures.

The new highway passes through the gorge of Tehachapi Creek. The

Southern Pacific Railroad also passes through the gorge on the opposite side of the creek from the highway.

Tehachapi Creek is normally a small inoffensive stream but occasionally storms of cloudburst proportions turn the stream into a raging torrent. At peak flood it has been estimated to carry 33,000 second feet.

Two floods of recent years have taken many lives and caused much damage to the railroad and considerable damage to the highway slope protection where channel changes had been made.

SEVERE FLOOD DAMAGE

One of these floods occurred in September, 1932. Seven bridges of the Southern Pacific Railroad were successively blocked with debris and then swept downstream with the impounded water. When the flood passed the railroad station of Woodford it undermined the banks supporting a railroad siding. Two locomotives were toppled into the stream and buried so deep with debris it was necessary to use a magnet to locate one of them.

When the flood reached the large arch at Stoney brook it topped the arch and railroad tracks and carried two freight trains downstream. Freight cars were found two miles downstream from the arch.

Several people had stopped at a small service station just below the arch on the bank of the stream, because of the storm, and although warned of the oncoming flood by a railroad brakeman, they were unconvinced of their danger and remained at the service station until carried away by the flood. Eighteen bodies were found in the flats below after the flood.

FLOOD IN 1945

Another flood occurred in October, 1945. The rain in some areas was accompanied by hail. At one place a pond formed behind a highway embankment and the highwater line of the pond was banked with hailstones. Two days after the storm photographs were taken of clusters of hail stones as large as a football, the individual stones being about the size of cherries.

This flood did considerable damage to the Southern Pacific Railroad near Keene and to the slope protection on the highway embankments in the gorge. The erosive power of the stream was demonstrated in several ways, one of which was carrying away all rock from the damaged slope protection and all rock that had been left in the creek bed by the workmen because they were too large to place with a 5-ton derrick.

The damaged walls and slope pavement have been rebuilt and carried down into the stream bed to a depth of 12 feet or to bedrock. The slope pavement rests on concrete toe walls carried 12 feet below the stream bed. They are reinforced with three lines of railroad rails placed longitudinally in the base to prevent any section from pushing out of line. Stone masons were hard to find and the slope pavement was constructed by placing large rock on the slope with cranes and vibrating Class "A" concrete into the voids to a depth

Constructing base of toe wall for support of riprap at channel change







Upper — Heavy excavation near Keene Sanitarium. Lower — Section of completed Keene-Tehachapi highway

of 18 inches measured perpendicular to the slope. A blanket of earth was then spread over the slope pavement and kept moist through the curing period. This method eliminated all possible voids and made certain that the mortar was properly cured. The finished slope pavement presents an extremely rough appearance which fulfills one of the requirements of the specifications.

Imported borrow was placed on the roadway to a depth of one foot and mixed with SC-4 road oil to a compacted depth of 0.25 feet. An adjacent section of highway, which has given good service for several years, had the same treatment.

The writer has been Resident Engineer for the project. Tom Dunn was assistant in charge of bridges, and T. J. Canini has been assistant in charge of surveys. Mr. H. S. Booth was project manager for Guy F. Atkinson Company.



Section of U.S. 3 between Shingle Springs and El Dorado where new state highway eliminates many curves

Projects on U.S. Route 40 and U.S. Route 50

By P. C. Sheridan, Associate Highway Engineer

SEVERAL of the projects on U.S. Route 40, U.S. Route 50 and State Route 49, which were a part of the postwar program, are now completed or nearing completion.

The project described in the article titled "Eliminating 29 curves on U.S. 50 Between Shingle Springs and El Dorado" by S. H. Lathrop contained in the May-June, 1946, issue of *California Highways and Public Works*, has been completed and recently opened to traffic.

This 3.4 mile project extends from Shingle Springs to 1¾ miles west of El Dorado and was constructed at a cost of $270,000. The work included 181,000 cubic yards of roadway excavation; 27,400 cubic yards imported borrow for blanketing the poor quality native material; 14,300 tons of crusher run base; and 7,800 tons of plant-mixed surfacing.

The new road provides a 22-foot plant-mixed surfacing on a 30-foot roadbed.

The road traverses rolling foothill country used mainly for grazing with a small amount of general farming.

AUBURN PROJECT

The project on U.S. Route 40, a limited access highway now nearing completion, in contrast, passes through the City of Auburn. This project has previously been described in an article titled "Old 'Diggins' Scene of Road Work," by J. L. Piper contained in the November-December, 1946, issue of *California Highways and Public Works*. It is anticipated that this section will be opened to traffic during October.

The present highway winds through the business and residential streets of Auburn. On the present alignment there are right angle turns; a stretch of narrow width; several steep grades; a narrow underpass with one approach and a blind right angle turn. None of the streets in Auburn over which the present traffic is routed accommodates over two lanes of moving traffic.

The minimum radius of curvature on the new alignment is 1,000 feet, and the maximum grade is 6 percent.

GRADE SEPARATIONS

The new construction extends from one-tenth mile west of Nevada Street



Construction scene on State Sign Route 49 at Auburn, looking north from intersection, where highway underpasses U. S. 40

in Auburn to one mile east of Auburn, is 2.6 miles in length and is four-lane divided except at the ends where transitions are made to the existing two-lane pavements.

Under separate contracts, grade separations were constructed at East Street and Walsh Street and over the Southern Pacific Railroad westbound main line track.

The grade separation at East Street and connecting ramps will provide an interchange from the highway to the business district of Auburn and to the new relocation of State Route 49 to Grass Valley.

In order that the East Street traffic interchange facility function properly, it was desirable that the State Route 49 relocation adjacent to U.S. Route 40 be constructed concurrently. Within the limits of the northerly portion of the Route 49 relocation, a grade separation with the eastbound track of the Southern Pacific Railroad is being constructed. Because of the structural steel shortages, the Route 49 project was contracted in two units. The southerly unit is now completed and will be opened to traffic at the same time as the U.S. Route 40 project.

Work on the road portion of northerly unit will probably be suspended until next spring due to the delay in completing the underpass under the railroad.

Portland cement concrete is the pavement type on the U.S. 40 unit, and plant-mixed surfacing on crusher



This new section of U. S. 50 between Pollock Pines and Fresh Pond was constructed by the United States Public Roads Administration



This is another view of new four-lane highway on U. S. 50 near Fresh Pond

run base is used on connecting roads and ramps.

The two units on State Route 49, also a limited access highway, provide 22 feet of plant-mixed surfacing on a 36-foot roadbed, for a distance of 3.6 miles. The combined units extend from the junction with U.S. Route 40 in Auburn to Rock Creek.

The work on the three road contracts in the vicinity of Auburn includes about 441,000 cubic yards of excavation; 33,650 cubic yards of imported subgrade material; 24,000 tons of crusher-run base; 13,500 tons of plant-mixed surfacing; and 12,750 cubic yards of Portland cement concrete pavement.

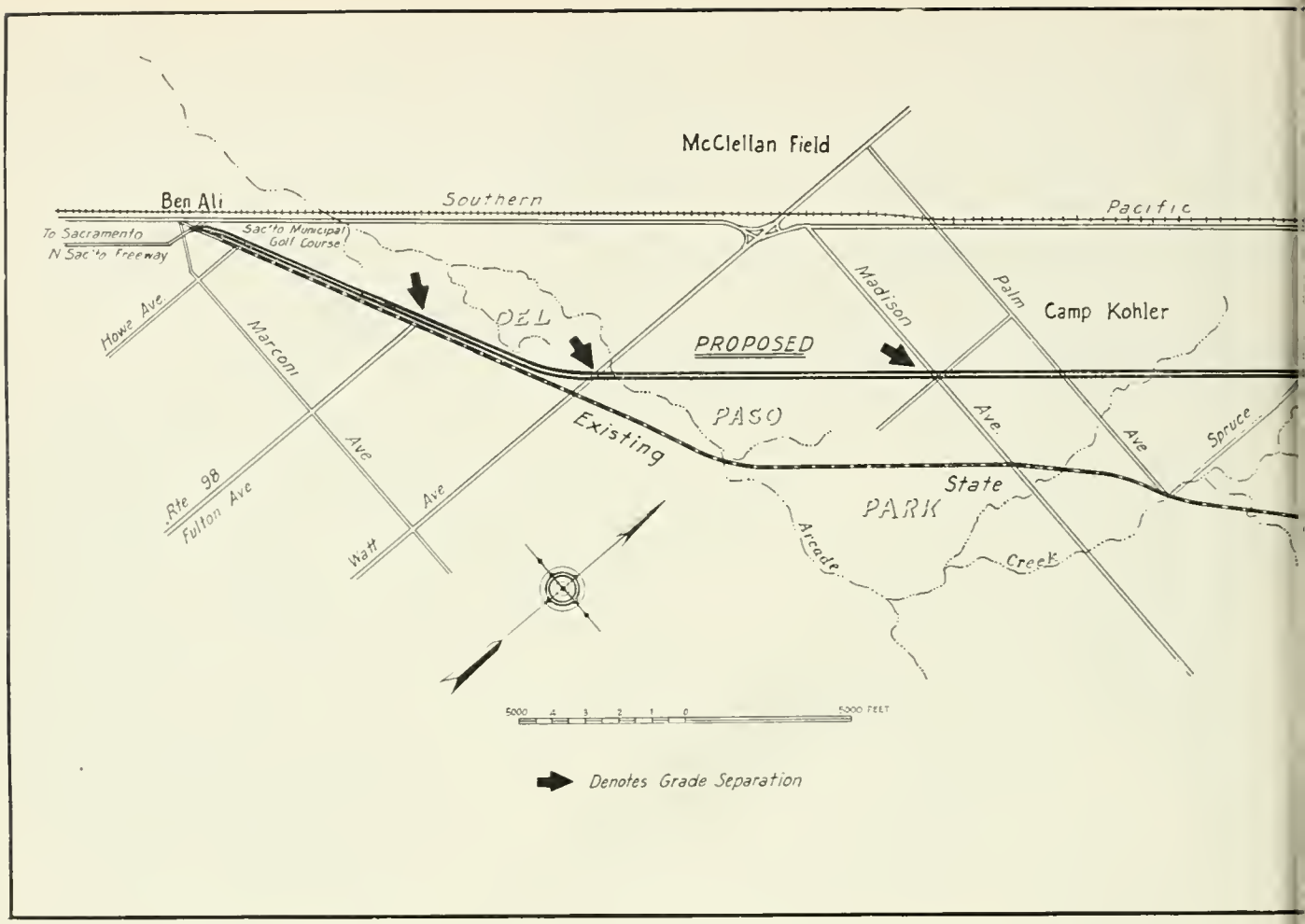
The projects, including the structures built under separate contracts, will cost approximately $1,280,000.

The contract on U.S. Route 50 was constructed by the Utah Construction Company of Salt Lake City and the road contracts in the vicinity of Auburn are being constructed by the Frederickson and Watson Construction Company of Oakland. The work is under the supervision of C. H. Whitmore, District Engineer.

The portion of U. S. 50 between Pollock Pines, which is about 15 miles east of Placerville, and the California-Nevada state line at the south end of Lake Tahoe, comprises Forest Highway Route 32, Placerville-Lake Tahoe.

During this year two construction projects have been completed under contracts awarded and supervised by the Public Roads Administration, one designated 32-K, between Pollock Pines and Fresh Pond, and the other designated 32-J1 on the Meyers Grade extending from the Sierra Nevada summit easterly into the Lake Tahoe basin. Forest highway funds were used to finance both projects.

(Continued on page 18)



Relocation of U. S. 99E and U. S. 40 a

PLANS and surveys for relocation of U. S. 99E and U. S. 40 as a freeway from the end of the North Sacramento Freeway to a point on U. S. 40 one-half mile east of Roseville, have been authorized by the California Highway Commission.

These are primary highway routes, U. S. 99E proceeding at present through Roseville to Marysville and points north, and U. S. 40 branching from U. S. 99E at Roseville and proceeding easterly through Auburn and Donner Pass as a transcontinental highway.

The proposed relocation, as shown in the accompanying sketch, will be 1.1 miles shorter than the existing route; the design speed will be 60 miles per hour as compared with an average operating speed of 40 to 45 miles per hour on the present highway; freeway traffic will not be subject to crossing traffic, and roadways in each direction will be separated; the principal cross laterals will be carried under or over the freeway, some initially, others eventually, it being difficult to obtain right of way for separation and interchange ramps on the present route.

FREEWAY DESIGN PLANNED

Describing the plans of the Division of Highways, State Highway Engineer George T. McCoy said:

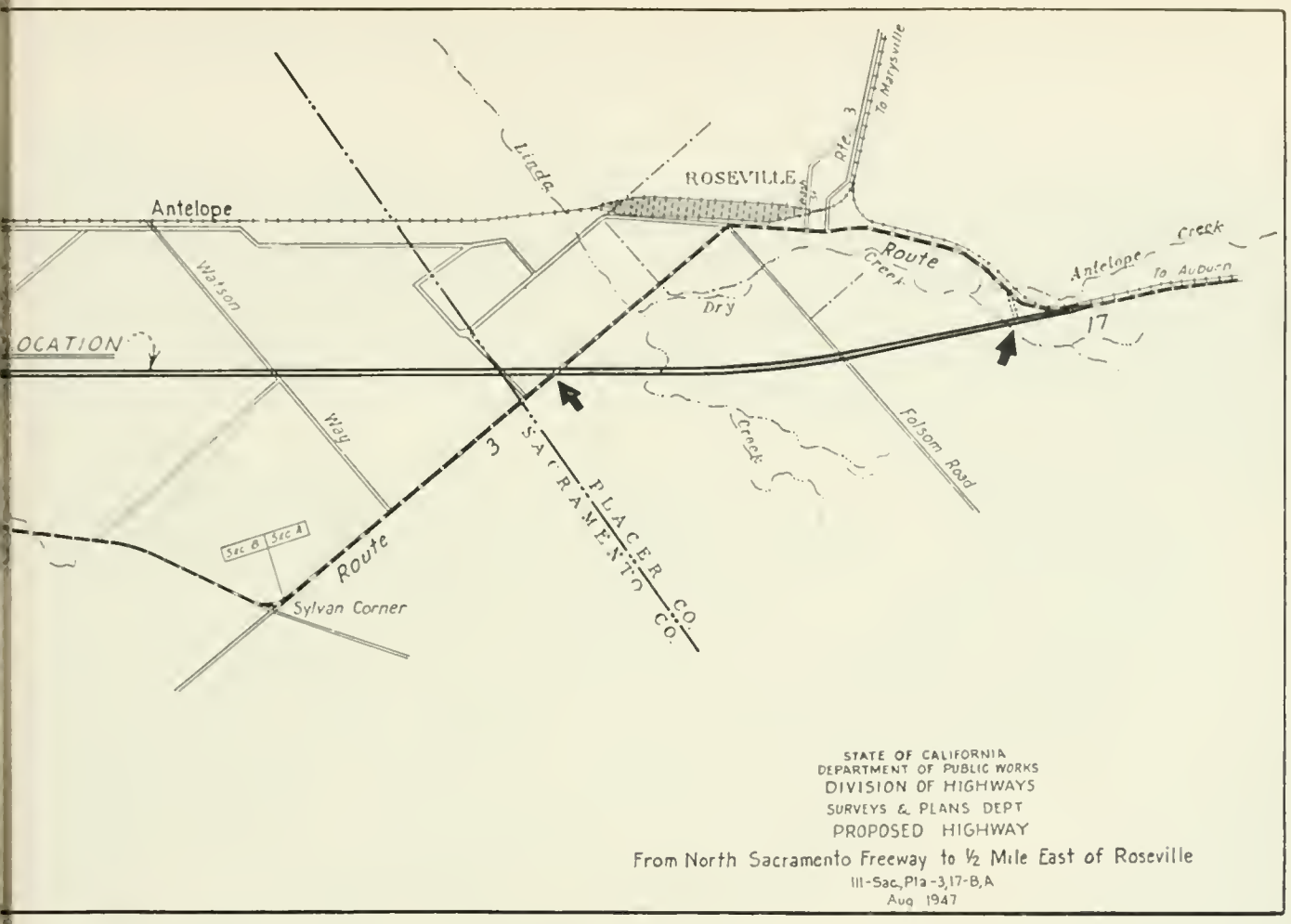
"Surveys and studies, aided by aerial maps, have already resulted in conclusive evidence that the project should be planned as a freeway on a revised location that will not disturb or destroy properties along the present highway.

"The present highway along this section is seriously inadequate for traffic that now exceeds 10,000 vehicles per day and has peak loads of 1,200 vehicles per hour. There have been 260 accidents on its 14 miles during the past three years, an accident rate that is 1½ times the average for all state highways.

"The addition of more lanes will not provide satisfactory results unless the marginal and intersectional friction from the fast-developing adjacent territory is also reduced. The only permanent solution that will prevent recurrence of present difficulties and obsolescence is establishment of the future highway on a permanent freeway basis whereby access will be provided through outer highways or public roads to limited designated intersections.

WILL EFFECT SAVING

"A limited freeway on the present road with hundreds of points of access to adjacent properties or with outer highways on each side to provide access to private properties, was the alterna-



reeway Extension Is Projected by State

tive that has the severe disadvantages of creating unusually high damages in acquiring frontage and moving back all the improvements within approximately 100 feet of the present center line, of constructing parallel roads, and of penalizing both through traffic and local traffic with the hazard and delay from frequent movements on, off, and across the highway.

"Suitable connections to existing facilities will provide a fast and convenient route for the semi-urban traffic to and from Sacramento and Roseville.

"In comparison with the existing road, the reduction in distance alone will save traffic about $2,000,000 in operating costs over a period of 20 years. The reduction in time of travel will represent an even larger amount of savings to traffic.

"A comparison between the cost of providing comparable standards of design on the new location as opposed to the expansion of the existing highway, discloses that the initial construction of rights-of-way cost will be over $1,500,000 cheaper on the new line.

NEW ROUTE SHORTER

"Thus, not only is the new location shorter in distance, more direct in alignment, and better for traffic service, but it is overwhelmingly superior in first cost.

"In the final economic analysis, the estimated savings to traffic operating on the proposed freeway for a 20-year period, plus the savings in rights-of-way and construction estimates on the new location, as compared with an alternate plan for the relatively inefficient improvement of the existing route, discloses the saving of a sum several times the estimated initial cost of the construction on the new location. Moreover, the improvements along the existing route will not be disturbed and the inherent value of the existing highway will remain for service to the adjacent area."

STATE HIGHWAY FUND
ESTIMATED REVENUES FOR THE 99th FISCAL YEAR

ESTIMATED REVENUES	TOTAL
Gas tax	$69,523,024
Motor vehicle fees (inc. caravan fees)	2,715,706
Use fuel tax (diesel)	2,806,990
Transportation tax	4,055,891
Federal aid and federal aid grade separation	16,696,305
Federal aid secondary (inc. highway planning)	1,236,456
Total	$97,034,372



These long, easy curves on U. S. 50 replace the hazardous old Meyers Grade between Echo Summit and Lake Tahoe

Projects on U. S. Route 40 and U. S. Route 50 Near Completion

(Continued from page 15)

The Pollock Pines-Fresh Pond project consisted of 3.1 miles of grading and plantmix bituminous surfacing, replacing the old, narrow and crooked road. Normal roadbed width on the new work is 32 feet except on the central 1.2-mile portion where a four-lane 46-foot width has been constructed. The minimum radius of curvature is 700 feet and the maximum grade is 7 percent. Studies indicated that the four-lane construction would be more economical than improving the alignment of a two-lane road to provide sight

(Continued on page 30)



Victorville Highway Improvement Will Eliminate Many Hazardous Curves

By WILLIS F. JONES, Assistant Highway Engineer

STATE Sign Route 18, a portion of which is shown on the accompanying "Vicinity Map," traversing the center of Southern California, links together a wide variety of terrain, climate, and scenery.

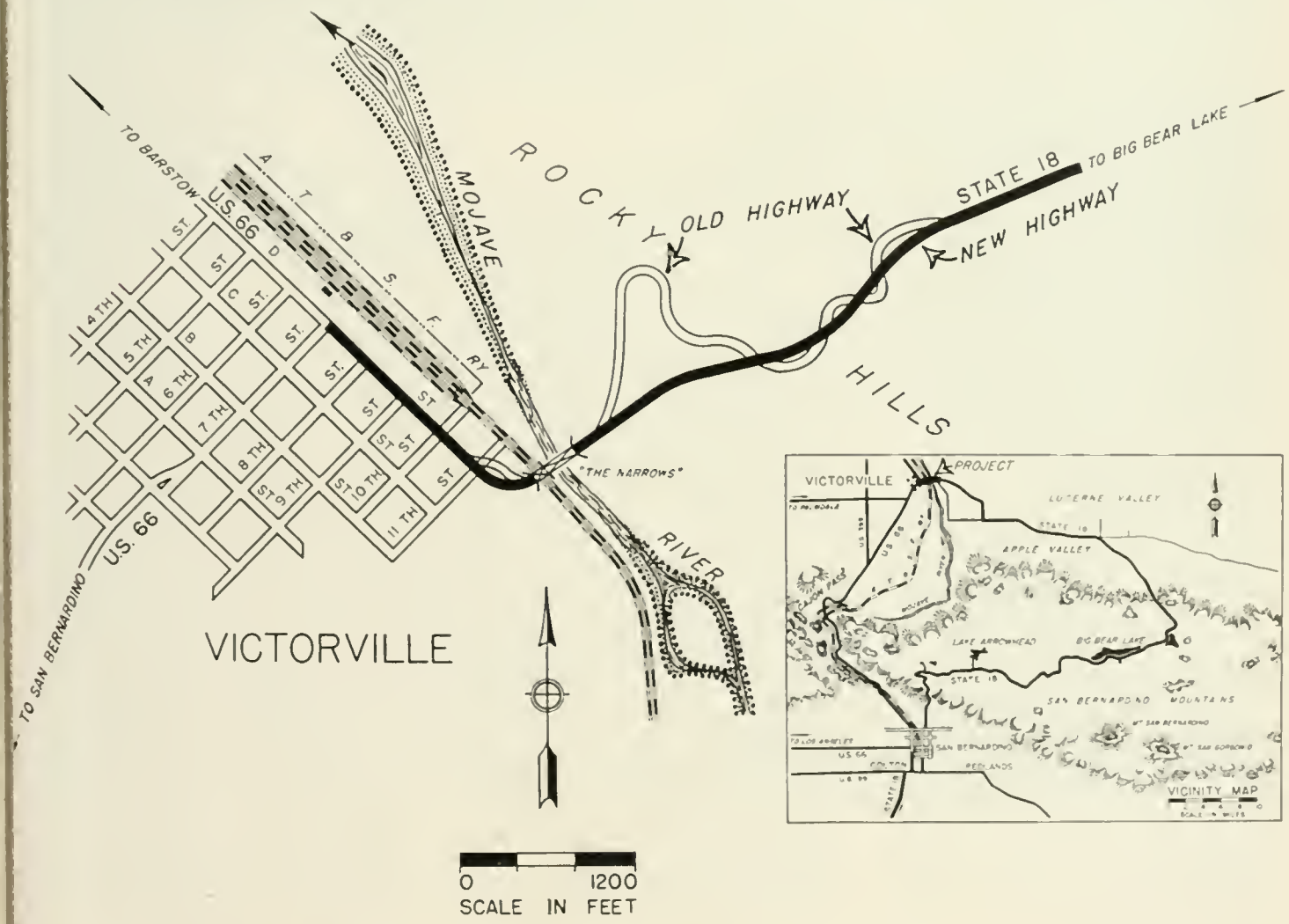
From sea level at Newport Beach, inland through picturesque Santa Ana Canyon and the valleys of the Citrus Belt, up into the San Bernardino Mountains over a modern mountain highway, through the largest patronized recreational area in the country; from elevations up to 7,200 feet above sea level the route sweeps on down into the great Mojave Desert to its junction with U. S. Highway 66 at Victorville at elevation 2,750.

It is here that the State has recently opened to traffic an improved section of this route. Beginning in the center of Victorville at the corner of Seventh and D Streets, the new route runs along D Street to and over the existing structures that span both the A. T. & S. F. Ry. and the Mojave River, then on through a small range of rocky hills to connect with the existing oiled highway leading toward Big Bear Lake.

Through these rocky hills in the comparatively short distance of one and a quarter miles, the new highway has eliminated one of the most hazardous and inadequate stretches of rural highway in Southern California.

Seventeen curves, some of the "hairpin" variety with radii as short as 50 feet made it impossible for trucks and trailers to negotiate them without blocking traffic or risking collision.

These numerous sharp curves have been replaced with four curves of easy transition ranging in radii from 1,000 to 2,000 feet designed for a safe driv-





Looking easterly from summit in Rocky Hills toward the easterly end of the Victorville project. Old road in left foreground

ing speed of 50 miles per hour. Gradients up to 9 percent have been replaced by those of high-gear standards.

The improvement in alignment is shown graphically on the accompanying map. Only the exigencies of war deferred this improvement. This route provides access to the San Bernardino Mountains, not only from the north but also provides an alternate winter route via Cajon Pass for traffic originating south of the mountains.

RAPID GROWTH

The town of Victorville is the trading center and shipping point for the area to the east which has been changing from a typical desert region to one of communities and agricultural development. Lucerne Valley and Apple Valley are typical examples of this development with their rapidly increasing production of alfalfa hay, livestock, and poultry, with some activity in mining. The health giving properties of the desert have resulted in the establishment of many guest ranches and dude ranches throughout the area.

This region was the locale of many incidents in early Southern California history from the expeditions of General Fremont through Lucerne Valley, to those of the historical Mormon trail that traversed the course of the Mojave River, where at the "Narrows" of this river the pioneers stopped for its never failing water.

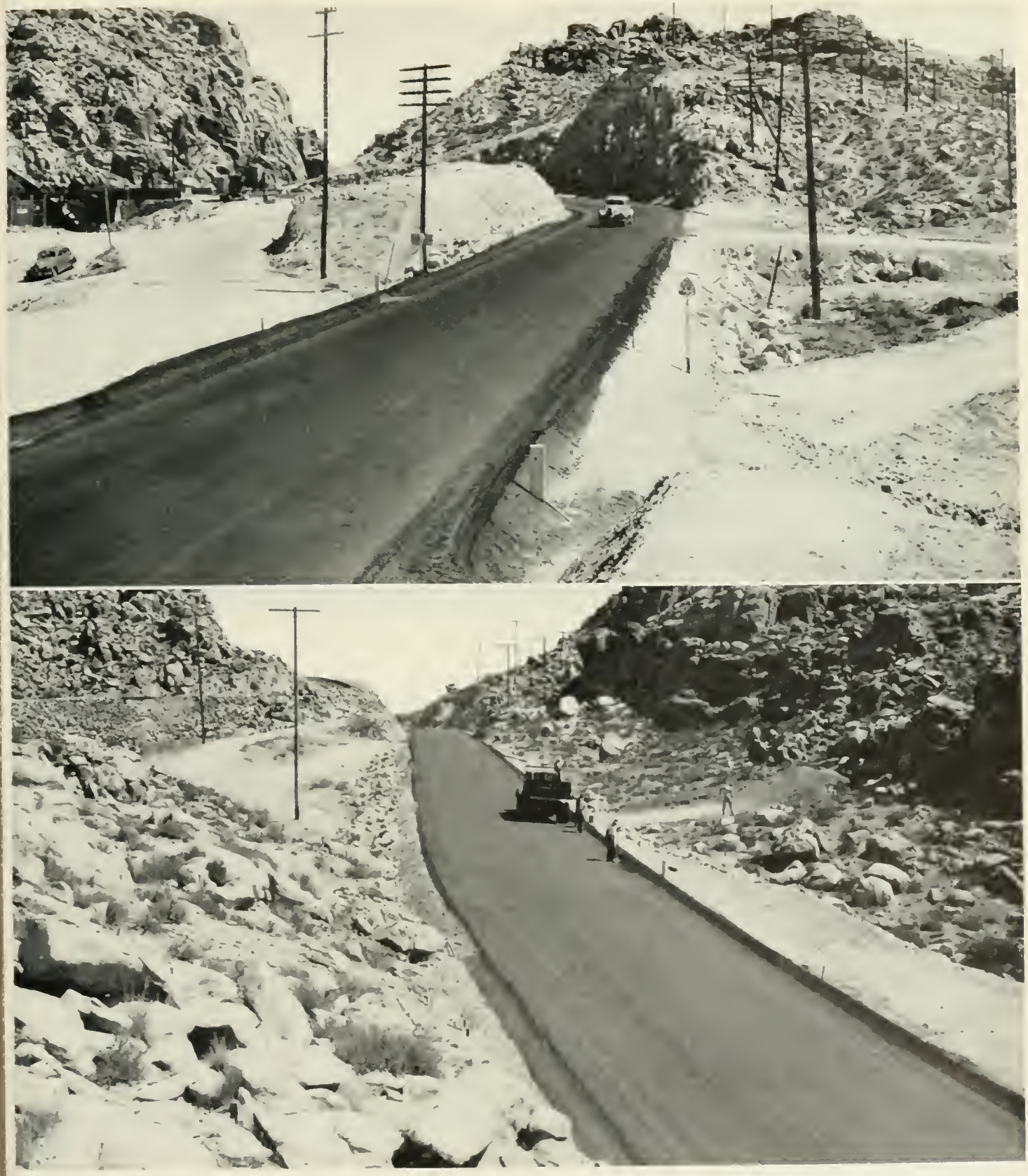
It was at this "Narrows" that a crossing of the Mojave River was selected by San Bernardino County since it provided the only feasible crossing in many miles, due to its rocky banks confining the bed of the stream within narrow limits as well as providing a stable and permanent anchorage for a bridge.

BRIDGE STRUCTURES

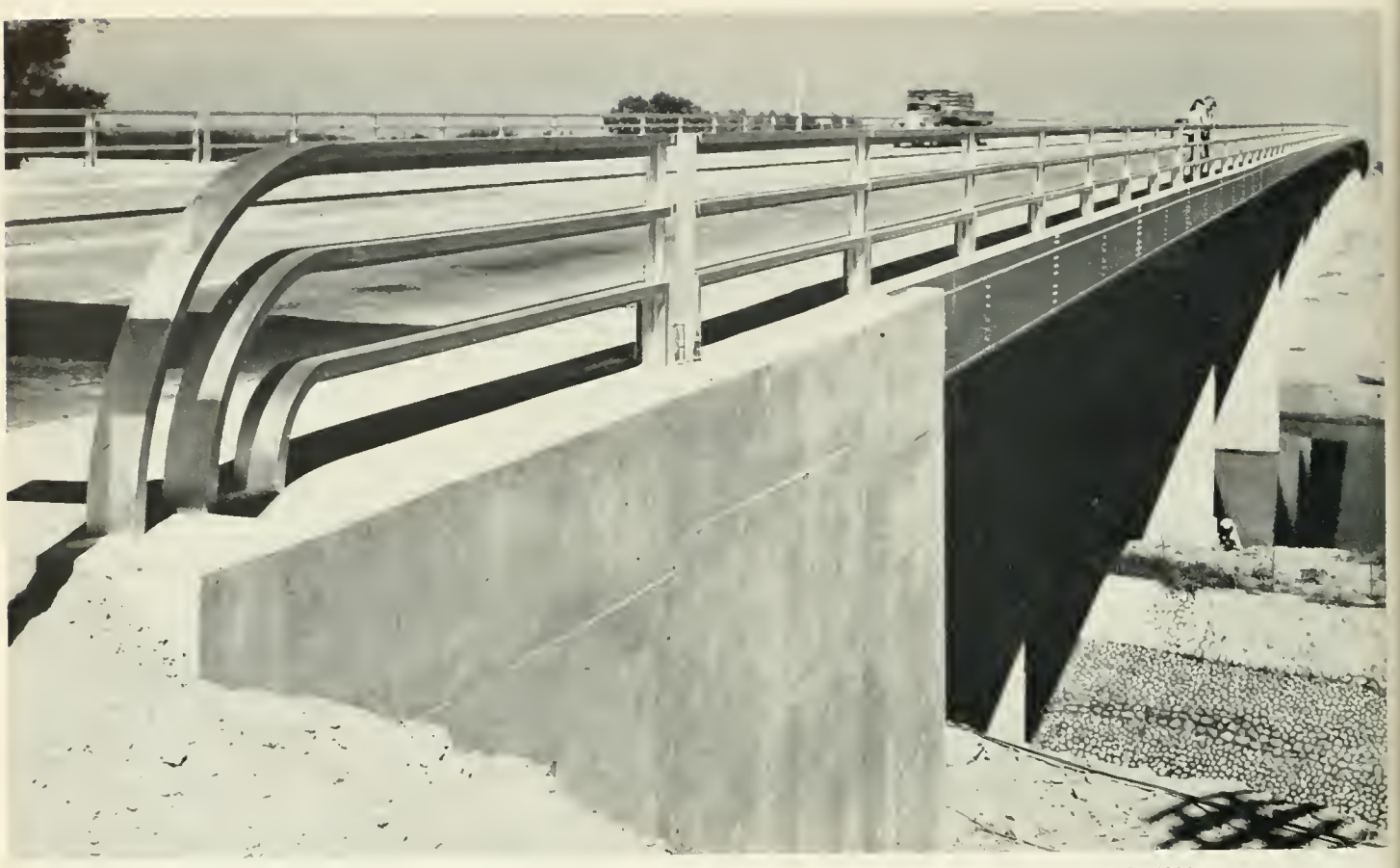
The present bridge over the Mojave River is a 254-foot span of steel box arch design, with a roadway of 20 feet between curbs. Abutting this bridge, to form a continuous roadway, is a structure over the A. T. & S. F. Ry. tracks, a 62-foot span of through steel girder design, with a roadway of 19 foot 4 inches between concrete wall railings. Outside of resurfacing for a short distance at the west end of these structures to provide the proper superelevation at this approach and the installation of guard railing at both approaches for increased safety, no work was necessary on the existing structures. At the west approach the former curve of very short radius was replaced with one of 280-foot radius. This approach lies adjacent to residential D Street where lower speed limits prevail.

The roadbed is of a standard width of 24 feet with an additional 3 feet on either side for a drainage gutter and a shoulder dike. This entire area is surfaced with a bituminous surface treatment applied by the road-mix method. Throughout the greater part of its length the roadbed lies in rocky material where a one-foot blanket of local material was applied, suitable for oiling. Side road and driveway approaches are surfaced with pre-mixed surfacing material. Traffic was carried through construction with a short detour at the summit.

The contract was awarded March 6, 1947, to Matich Bros. of Colton, California, for the sum of $94,486. Traffic is now using the new highway with only a few minor construction items remaining to be completed. This project is known as Road VIII-SBd-43-L. Kent B. Stone, Assistant Highway Engineer has acted as Resident Engineer on the project.



Upper—Looking southerly from Victorville toward the westerly approach to the Mojave River crossing at "The Narrows." At left is old road approach with bridges over the Atchison, Topeka and Santa Fe Railway. Lower—Looking easterly through gap in Rocky Hills. New road on right; old switchback road on left



This new steel bridge between Marysville and Yuba City replaces old span downstream built in 1906

New Feather River Bridge Dedicated

RESIDENTS of Yuba and Sutter and neighboring counties joined on Friday afternoon, September 19, in celebrating the completion of the new Marysville-Yuba City highway bridge across the Feather River. The affair was synchronized with the opening of the first Peach Bowl Festival held since Pearl Harbor.

A feature of the celebration was a barbecue, at which an estimated 15,000 visitors were served. Planes from Hamilton Field flew over the new span signalizing the start of a speech making program.

General Richard E. Mittelstaedt, State Utility Commission, represented Governor Earl Warren. Three California Highway Commissioners, Harrison R. Baker, Pasadena; Walter Sandelin of Ukiah, and Chester H. Warlow of Fresno, participated in the ceremonies, together with State Highway Engineer George T. McCoy, Deputy Director of Public Works A. H. Henderson, Bridge Engineer F. W. Panhorst, C. H. Whitmore, District Engineer, Division of Highways, and other engineers of the Department of Public Works.

BUDGET ITEMS

THE CURRENT highway budget provides for the following needed projects in Sutter County:

Live Oak line change, grade and surface 1.7 miles (bids will be opened on Oct. 1)	$214,000
Sutter Causeway, redeck portions of bridge	20,000
In Yuba and Sutter Counties:	
Landscaping, lighting and signals on Marysville-Yuba City Bridge and approaches (bids for this work will be opened next Oct. 15)	175,000
Total	$409,000

District Attorney Lloyd Hewitt of Marysville introduced prominent city and county officials, including Mayor H. C. Johnson of Marysville, Keith Kenyon, Yuba City Chamber of Commerce, and Jules E. Gerhardt, Chico.

Senator William P. Rich introduced attending State officials, including Assemblyman Bert Loomis, and presented the prineipal speakers, General Mittelstaedt and Commissioner Baker.

"Five blocks downstream on the Feather River stands the old bridge built in 1906 on the 19-foot wide 'wagon road,' as it was designated on the bridge plans. For over 40 years this bridge has served the needs of through and local traffic. However this traffic grew beyond the capacity of the old bridge, as shown by our July, 1946, traffic count of over 22,000 vehicles for one day, of which approximately 20 percent were trucks serving this great Peach Bowl agricultural area.

(Continued on page 31)



Upper—Attractive four-lane divided approach to new Marysville-Yuba City bridge on Marysville side of Feather River. Lower—Yuba City approach to new bridge

Traffic on State Highways Shows 8.8 Percent Increase Over 1946

By G. T. McCOY, State Highway Engineer

THE annual State-wide traffic count taken on Sunday and Monday, July 13th and 14th, shows an increase of 8.8 percent over the previous annual count of July, 1946. This very material growth in highway traffic, now 28 percent above the high prewar year of 1941, is found throughout the entire system. All groups show very similar gains. In the minor instances where individual routes indicate percentage losses from 1946, these are mostly accounted for by the fact that the 1946 counts for these routes were abnormally high. Unlike the gains shown in 1946, which were predominantly in passenger car traffic, this year's increases were quite uniform for both passenger and freight vehicles.

No change was made from the regular procedure of previous years in the manner of taking the count. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday, totals being shown for each hour. At selected representative stations counts are also continued for the entire 24-hour period and are extended to record each of the seven days of the week. Traffic is segregated into the following vehicle classifications: California passenger cars, out-of-state passenger cars, buses, pickups, two-axle commercial units, three-axle units, four-axle units, five-axle units, and six-or-more-axle units.

Each year some minor changes in the census become necessary, such as the relocation, addition, or discontinuance of individual stations; but in every instance these are excluded in determining comparison with the previous year, only those stations that were identical during both years being taken into consideration.

These comparisons for the various route groups are as follows:

PERCENT GAIN OR LOSS FOR 1947 COUNT AS COMPARED WITH 1946

	Sunday	Monday
All Routes	+ 8.29	+ 8.93
Main North and South Routes	+ 8.16	+ 8.77
Interstate Connections	+10.32	+11.14
Laterals Between Inland and Coast	+ 7.75	+ 9.23
Recreational Routes	+10.04	+ 6.28

The gain or loss of traffic volume for State Highway Routes 1 to 80, inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation:

Route	Termini	1947 Percent gain or loss Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
1.	Sausalito-Oregon Line	9.16		11.67	
2.	Mexico Line-San Francisco	8.19		9.89	
3.	Sacramento-Orgeon Line	15.34		10.65	
4.	Los Angeles-Sacramento	8.92		6.56	
5.	Santa Cruz-Jct. Rt. 65 near Mokelumne Hill	6.61		7.90	
6.	Napa-Sacramento via Winters	23.55		9.64	
7.	Crockett-Red Bluff	4.23		4.36	
8.	Ignacio-Cordelia via Napa	4.76		5.88	
9.	Rt. 2 near Montalvo-San Bernardino	7.38		13.14	
10.	Rt. 2 at San Lucas-Sequoia National Park	9.49		8.04	
11.	Rt. 75 near Antioch-Nevada Line via Placerville	5.04		8.64	
12.	San Diego-El Centro	7.22		13.78	
13.	Rt. 4 at Salida-Rt. 23 at Sonora Jct.	10.25		13.40	
14.	Albany-Martinez	10.56		5.65	
15.	Rt. 1 near Calpella-Rt. 37 near Cisco	12.31		24.05	
16.	Hopland-Lakeport	11.85		9.61	
17.	Rt. 3 at Roseville-Rt. 15, Nevada City	5.58		12.26	
18.	Rt. 4 at Merced-Yosemite National Park	0.57		17.41	
19.	Rt. 2 at Fullerton-Rt. 26 at Beaumont	5.79		4.77	
20.	Rt. 1 near Arcata-Rt. 83 at Park Boundary	23.38		21.02	
21.	Rt. 3 near Richvale-Rt. 29 near Chilcoot via Quincy	15.12		21.32	
22.	Rt. 56, Castroville-Rt. 29 via Hollister	16.73		8.87	
23.	Rt. 4 at Tunnel Sta.-Rt. 11, Alpine Jct.	10.32		11.12	
24.	Rt. 4 near Lodi-Nevada State Line	9.01		17.48	
25.	Rt. 37 at Colfax-Rt. 83 near Sattley	29.16		22.94	
26.	Los Angeles-Mexico via San Bernardino	4.52		8.49	
27.	El Centro-Yuma	16.05		19.40	
28.	Redding-Nevada Line via Alturas	23.09		15.77	
29.	Peanut-Nevada Line near Purdy's	22.21		19.46	
31.	Colton-Nevada State Line	12.75		13.34	
32.	Rt. 56, Watsonville-Rt. 4 near Califa	14.26		12.61	
33.	Rt. 56 near Cambria-Rt. 4 near Famoso	7.97		7.97	
34.	Rt. 4 at Galt-Rt. 23 at Pickett's Jct.	28.23		45.52	
35.	Rt. 1 at Alton-Rt. 20 at Douglas City	29.02		11.52	
37.	Auburn-Truckee	7.12		6.82	
38.	Rt. 11 at Mays-Nevada Line via Truckee River	7.94		0.66	
39.	Rt. 58 at Tahoe City-Nevada State Line		19.77		0.90
40.	Rt. 13 near Montezuma-Rt. 76 at Benton	27.71		8.54	
41.	Rt. 5 near Tracy-Kings River Canyon via Fresno	12.14		16.15	
42.	Redwood Park-Los Gatos	4.86		18.82	
43.	Rt. 60 at Newport Beach-Rt. 31 near Victorville	2.39			7.57
44.	Boulder Creek-Redwood Park		6.00	23.77	
45.	Rt. 7, Willows-Rt. 3 near Biggs	9.42		21.79	
46.	Rt. 1 near Klamath-Rt. 3 near Cray	45.12		12.42	
47.	Rt. 7, Orland-Rt. 29 near Morgan	22.51		8.92	
48.	Rt. 1 N of Cloverdale-Rt. 56 near Albion	25.19		5.02	
49.	Napa-Rt. 15 near Sweet Hollow Summit	5.52		4.62	
50.	Sacramento-Rt. 15 near Wilbur Springs	12.10		8.27	
51.	Rt. 8 at Shellville-Sebastopol	4.79		1.73	
52.	Alto-Tiburon		3.07	4.95	
53.	Rt. 7 at Fairfield-Rt. 4 near Lodi via Rio Vista	7.67			1.55
54.	Rt. 11 at Perkins-Rt. 65 at Central House		7.09	5.43	
55.	Rt. 5 near Glenwood-San Francisco	1.68			2.05
56.	Rt. 2 at Las Cruces-Rt. 1 near Fernbridge	26.26		18.76	
57.	Rt. 2 near Santa Maria-Rt. 23 near Freeman via Bakersfield	15.38		10.71	
58.	Rt. 2 near Santa Margarita-Arizona Line near Topock via Mojave and Barstow	15.42		10.49	
59.	Rt. 4 at Gorman-Rt. 43 at Lake Arrowhead	12.53			0.79
60.	Rt. 2 at Serra-Rt. 2 at El Rio	31.40		5.07	
61.	Rt. 4 S. of Glendale-Rt. 59 near Phelan	8.00		11.41	
62.	Rt. 171 at Northam-Rt. 61 near Crystal Lake	17.61		22.44	
63.	Big Pine-Nevada State Line	32.54		2.20	
64.	Rt. 2 at San Juan Capistrano-Blythe	3.66		3.42	
65.	Rt. 18 near Mariposa-Auburn	8.97		16.82	
66.	Rt. 5 near Mossdale-Rt. 13 near Oakdale	37.07		25.81	
67.	Pajaro River-Rt. 2 near San Benito River Bridge		27.21		28.00
68.	San Jose-San Francisco	11.20		14.86	
69.	Rt. 5 at Warm Springs-Rt. 1, San Rafael	7.19		2.50	
70.	Ukiah-Talmage	16.21		13.74	
71.	Crescent City-Oregon Line	27.63		18.93	
72.	Weed-Oregon Line	33.15		40.45	
73.	Rt. 29 near Johnstonville-Oregon Line	34.27		24.07	
74.	Napa Wye-Cordelia via Vallejo and Benicia	4.96		6.75	
75.	Oakland-Jct. Rt. 65 at Altaville	4.77		12.65	
76.	Rt. 125 at Shaw Ave.-Nevada State Line near Benton	18.78		10.08	
77.	San Diego-Los Angeles via Pomona	8.83		4.36	
78.	Rt. 12 near Descanso-Rt. 19 near March Field	1.31		6.06	
79.	Rt. 2, Ventura-Rt. 4 at Castaic		4.32	7.36	
80.	Rt. 51, Rincon Creek-Rt. 2 near Zaca	7.59		11.83	

Link in Fresno-Coalinga County Road Completed

ON JUNE 4, 1947, Fresno County completed its first Federal Aid Secondary (County) road project under the Federal Aid Highway Act of 1944 and the County Highway Aid Act of 1945, at a cost of approximately $160,000.

The project provided for reconstruction on the Fresno-Coalinga road from three miles southwest of Five Points to approximately nine miles southwesterly.

This route is the most direct between Fresno and Coalinga and serves the rich agricultural area in the vicinity of Five Points as well as oil field areas. The route is among the more important of Fresno County's arteries and is typical of Federal Secondary Roads.

Design features provided for a total thickness of 12 inches of new material including 3 inches of bituminous treated surfacing, two traffic lanes of 11 feet each and three-foot oiled shoulders.

The reconstruction was programed by the Fresno County Board of Supervision because the destructive effects of increasing truck loadings had made the original lighter construction unmaintainable.

All engineering work was handled by the staff of County Engineer, A. J. Nielson, assisted by the Division of Highways Laboratory and District personnel. Edgar C. Smith was Resident Engineer on the project.

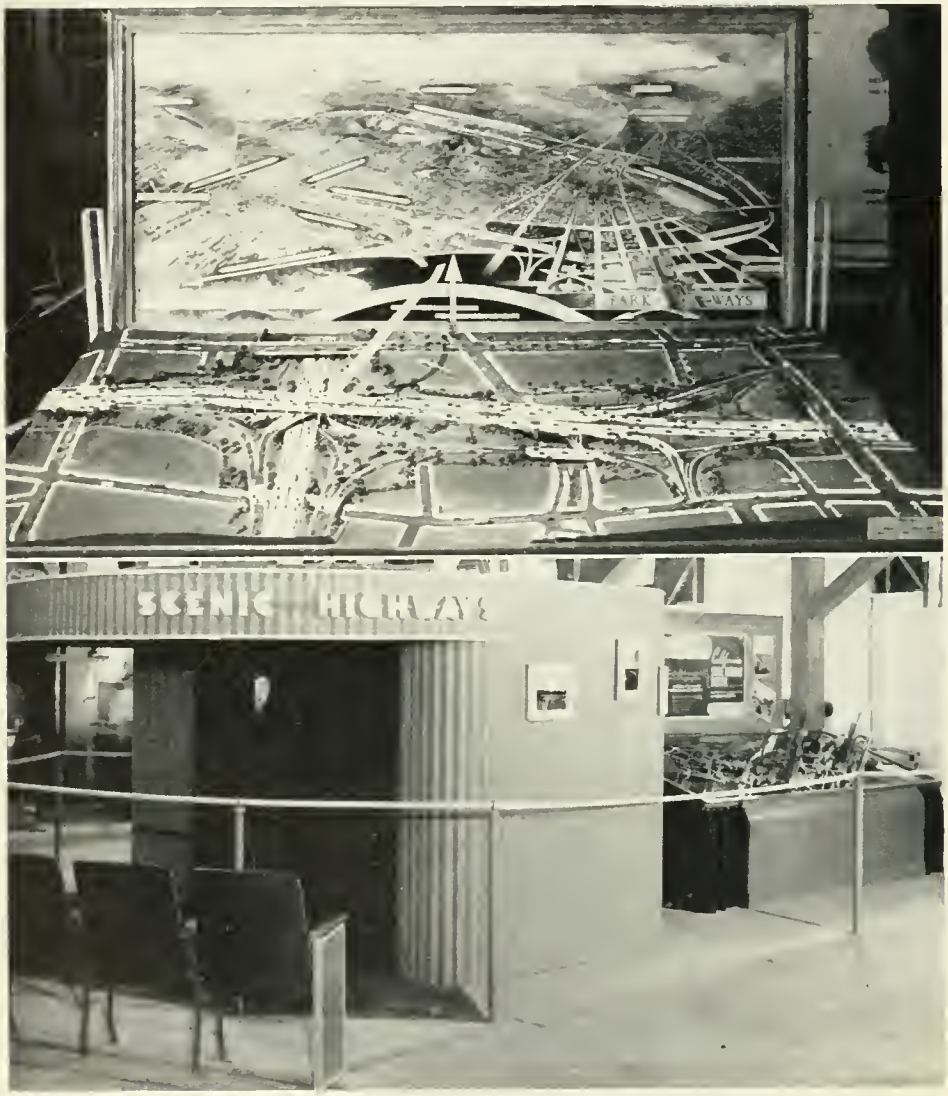
Penalties Increased for Drunk, Negligent Driving

Penalties for drunken driving and for negligent driving were made more severe by the 1947 session of the State Legislature in response to public demand for increased safety on the highways. The law now requires that the license of any person convicted of drunken driving shall be suspended for 90 days for the first offense, instead of 30 days as previously provided. For a second or subsequent offense, the period of license suspension is set at one year, instead of 90 days, as previously.



Upper—Looking northeast at point 5.5 miles southwest of Five Points. Center—Looking southwest toward Coalinga from a point 6.5 miles southwest of Five Points. Lower—Looking northeast from point 6.5 miles southwest of Five Points

Highways Exhibit at State Fair Proves to be Big Attraction



THOUSANDS of visitors to the California State Fair this year visited the exhibit of the Division of Highways in the Education Building.

A sketch by Van der Goes of the Bridge Department of the division, eight feet by three feet, depicting the unique four-level grade separation structure at the intersection of Hollywood Parkway, Arroyo Seco Parkway, and Harbor Parkway, in the City of Los Angeles and a model of the same project attracted considerable attention.

In another section of the exhibit was a plastic model on which highway traffic variations in terms of thin vertical planes were shown. Tall flourescent cylinders marked the cities and each vertical plane represented a state highway, with the height proportional to the volume of traffic in each section. Lowest points on the plane corresponded to an average traffic of 250 vehicles a day and the highest point represented a 70,000 vehicle a day traffic on the San Francisco-Oakland Bay Bridge.

Widening of U. S. 9

(Continued from page 6)

ure, placed this project near the top of the list of projects to be constructed in the immediate postwar period.

In April, 1946, Griffith Company of Los Angeles was awarded the major contract of grading and paving at a cost to the State of $433,000. A concurrent contract for constructing traffic-actuated signals and intersection lighting at five locations was awarded to the Oilfields Electric Company of Ventura at a cost to the State of about $40,000.

COMPLETED IN MARCH

Actual construction began in May, 1946, and the major contract was completed in March of this year.

The contract for traffic signals and lighting has been completed except for the installation of the luminaries. The traffic-actuated signals have been in operation since August and all reports to date on their handling of traffic have been highly satisfactory.

Grading and paving work was unusually difficult because of having to carry the large volume of traffic through construction, and also having to maintain access to the many commercial establishments which border the project throughout.

HEAVY GRADING

The work was confined to the existing 115.5-foot and 110-foot right of way which required that heavy grading operations be conducted within a few feet of buildings and other improvements. The relocation of pole lines, sewers, gas lines, water lines, telephone conduits and other utilities had to be coordinated with the progress of the contract work.

The cross-section of the highway in general consists of two 12-foot and one 11-foot lane on each side of a 17-foot curbed and planted median strip. An 8-foot parking lane borders each edge of the six-lane pavement. Curbs, gutters and sidewalks occupy the remainder of the right of way.

Low bearing ratios and the loose condition of the native soils required that excavation and compaction work be carried to a depth of three feet below profile grade. Only a small portion of the material excavated could be used in the fill because of its poor quality and was therefore disposed of

Bakersfield

by the Contractor. A 12-inch thickness of high quality imported borrow was placed beneath the pavement subgrade and where Portland cement concrete pavement was used, the upper 3 inches of the imported borrow was plant-mixed with 85-100 penetration paving asphalt to keep moisture out of the subgrade.

THREE TYPES OF PAVEMENT

Pavement used on this project was of three general types. Asphalt concrete 3 inches thick over either old pavement or over 7 inches of Portland cement concrete base was used on about three-fourths of the project. North of 19th Street, where the old pavement was failing badly, it was removed and replaced with 8 inches of Portland cement concrete pavement. At the north end of the project 3 inches of plant-mixed surfacing over 5 inches of crusher run base was used as a temporary transition to the existing four-lane pavement.

Due to the large number of left turns at several of the intersections, special storage lanes were added by cutting into the median strip. The accompanying photographs show these very clearly and show how the three normal lanes of traffic in each direction are unhampered by left turning vehicles.

WILL INCREASE SIGNALS

At the present time the vehicles making left turns move with the green light for the six-lane highway. Eventually, as traffic increases, the vehicles making left turns will find it difficult to find an opening in the on-coming traffic. When this time comes, a third phase can be wired into the signals at a nominal cost to allow the left turns to be made while opposing traffic is stopped. Practically all of the underground work for this added feature was included in the present project.

Structures included in the project included extensions to an existing pedestrian underpass at Fremont School and extensions to two medium sized box culverts.

The State was represented on the project by J. W. Cole and W. M. Nett as resident engineers.

The project superintendent for Griffith Company was T. I. Gibson. M. H. Blacklock superintended the signal and lighting work for the Oilfields Electric Company.

New Highway in Solano and Yolo Counties Is Officially Dedicated

SOLANO and Yolo Counties celebrated on Saturday, August 23d, the completion of the first unit of the Vacaville-Dunnigan Cut-off. Dedication ceremonies were held at the junction of the new highway with U. S. 40 two miles east of Vacaville.

Officials of the two counties and representatives of civic organizations of Vacaville and Winters attended the dedication. State Highway Commissioner Homer P. Brown of Placerville was the principal speaker. Following the ceremonies the invited guests were tendered a luncheon by the Winters Chamber of Commerce.

For years a low standard of alignment on narrow rights of way and a number of blind vertical curves hindered traffic movement between the Yolo-Solano county line and Vacaville. This condition existed because the old seven-mile portion of State Route 90 between Vacaville and Allendale Station followed rolling foothill roads, which were adapted only to traffic of low density.

Although the old road will probably remain for the convenience of local residents, much safer and faster traffic movement is provided by the new relocation. This somewhat shorter route begins at the intersection of U. S. 40 with the Vacaville-Dunnigan portion of the Sacramento Valley Highway.

Closely paralleling the way stations at Hartley, Allendale, and Wolfskill on the Southern Pacific Railroad between Vacaville and Winters, the new route crosses Pine Tree, Horse, Gibson Canyon, Sweeney, and Putah Creeks, and terminates on the Solano-Yolo county line at the southerly town limits of Winters.

The new cut-off eliminates three dangerous grade crossings with the branch line railway. Likewise, several right-angled, short radius curves are done away with. Sight distances on vertical curves are improved materially, and wider and stronger stock crossing structures have been introduced.

In the future it will be necessary to parallel the two-lane, seven-mile section with an equally wide alternate direction pavement of modern design.



Commissioner Homer P. Brown

At such time, the need and convenience of a four-lane divided freeway on this lower Sacramento Valley route will become apparent to the motoring public.

Considerable saving is made in distance over that on the old road. Five pleasingly designed concrete bridges add to the scenic and safety features of the Winters-Vacaville State Highway.

This southerly portion of the Dunnigan Cut-off was built by contract awarded to Fredrickson Brothers of Emeryville. The cost to the State has exceeded $750,000, including day-labor and maintenance account supplemental work in the vicinity of Winters.

The new westerly two lanes of the eventual four-lane divided freeway have been paved 24 feet wide and eight inches thick. In addition, there is an eight-foot, seal-coated shoulder bordering the Portland cement concrete pavement. An imported creek-run gravel base 22 inches thick stabilizes the previously unsatisfactory subgrade.

Highway Bids and Contract Awards for August and September, 1947

August, 1947

ALAMEDA COUNTY—At Fruitvale Avenue in the City of Oakland, the superstructure for an overhead structure over the tracks of the Southern Pacific Railroad to be constructed. District IV, Route 69. Haas & Rothschild, San Francisco, $646,722; Judson Pacific Murphy Co., Emeryville, $647,414; S. J. Amoroso Construction Co., San Francisco, $648,252; Stolte, Inc. & The Duncanson Harrelson Co., San Francisco, $648,449; Chas. L. Harney & A. Soda & Son, San Francisco, $674,266; Guy F. Atkinson Co., South San Francisco, $705,301; Fredrickson & Watson Construction Co., Oakland, $736,896; Clinton Construction Co. of California, San Francisco, $742,166; Fredrickson Bros., Emeryville, $759,501. Contract awarded to J. H. Pomeroy & Co. Inc., San Francisco, $646,322.40.

FRESNO COUNTY—Between one-fourth mile south of Fowler and Calwa Overpass (portions) about 6.4 miles in net length, concrete curbs to be constructed. District VI, Route 4, Section A, Fow, B, Ted F. Baun, Fresno, $17,901; C. J. B. Construction Co., Oxnard, $30,565. Contract awarded to F. Gunner Gramatky, Fresno, $15,775.50.

KERN COUNTY—Between Keene and Tehachapi, the superstructures for two bridges across Tehachapi Creek and for two combined bridge and overhead structures across Tehachapi Creek, and the tracks of the Southern Pacific Company, to be constructed. District VI, Route 58, Sections E, F, Haddock Engineers, Ltd., Oceanside, $410,368; H. B. Nicholson, Pasadena, $412,509; Byerts & Dunn, Los Angeles, $462,027. Contract awarded to Guy F. Atkinson Company, South San Francisco, $392,390.10.

LAKE COUNTY—Between Route 89 and one mile west of Lower Lake, about 5.1 miles to be graded and Class "B-Double" seal coat applied. District I, Route 1039. Dix-Syl Construction Co., Inc., Bakersfield, $131,187.50; N. M. Ball Sons, Berkeley, $141,291; A. G. Raisch Co. & Staring & Galbraith, San Francisco, $156,849; Piombo Construction Co., San Francisco, $162,908; Fredrickson Bros., Emeryville, $164,189; Johnston Rock Co. and Gordon L. Capps, Stockton, $171,828; Fredrickson & Watson Construction Co., Oakland, $198,218. Contract awarded to Morrison-Knudsen Company, Inc., San Francisco, $111,-182.30.

LASSEN COUNTY—At Baxter Creek, about 2 miles north of Janesville, about 1.1 miles to be graded and surfaced with road-mixed surfacing on cement treatment. District II, Route 29, Section C. A. Teichert & Son, Inc., Sacramento, $109,766. Contract awarded to Fredrickson & Watson Construction Co., Oakland, $99,712.20.

LOS ANGELES COUNTY—Across Los Angeles River at Florence Avenue, near the City of Bell, a reinforced concrete bridge to be constructed and approximately 0.26 mile to be graded and paved with asphaltic concrete pavement and pre-mix pavement. District VII, Route 838. Guy F. Atkinson Co., Long Beach, $439,737; MacDonald & Kruse & Hensler Const. Corp., Glendale, $439,929; W. J. Disteli, Los Angeles, $443,061; Peter Kiewit Sons Co., Arcadia, $453,106; Carlo Bongiovanni, Los Angeles, $462,785; Dimmitt & Taylor & K. B. Nicholas, Los Angeles, $467,606; Byerts & Dunn, Los Angeles, $481,948; Griffith Co., Los Angeles, $490,384; Oberg Bros., Inglewood, $545,865; Haddock Co., Pasadena, $546,768. Contract awarded to H. B. Nicholson, Pasadena, $419,162.

MONO COUNTY—Near Coleville, Coleville Lane D and Coleville Lane B, about 3.4 miles to be graded and a penetration treatment applied. District IX, Route 1094. George E. France, Visalia, $58,467; Johnston Rock Co., Stockton, $61,600; Dix-Syl Construction Co., Inc., Bakersfield, $68,097; Isbell Construction Co., Reno, $72,154; Barney H. Stoutenburg, Carson City, $73,642. Contract awarded to Nevada Constructors, Inc., Reno, $54,582.71.

MONTEREY COUNTY—Across Big Sur River, in Pfeiffer-Big Sur State Park, a structural steel bridge with timber deck to be constructed. District V. Bos Construction Co., Oakland, $19,242; Stolte, Inc., Monterey, $23,650; Dan Caputo, San Jose, $25,325; Granite Construction Company, Watsonville, $34,485; C. J. B. Construction Co., Oxnard, $44,250. Contract awarded to Madonna Construction Co., San Luis Obispo, $18,480.

ORANGE COUNTY—Between El Toro and Irvine, about 2.2 miles, to be repaired with untreated rock base and plant-mixed surfacing. District VII, Route 2, Section B. Jesse S. Smith, Glendale, $61,700; Catalina Construction Co., Covina, $63,480; Griffith Co., Los Angeles, $65,770; Cox Bros. Construction Co., Stanton, $67,484; Oswald Bros., Los Angeles, $68,180; Sully-Miller Contracting Co., Long Beach, $69,570; Cee Tee Construction Corp., Puente, $73,305; Contract awarded to O'Brien & Bell Construction Co., Santa Ana, $59,328.50.

PLACER COUNTY—On county roads between Loomis and Auburn via Brennan's Corner and between Route 768 at Kister's Corner and Newcastle, about 11.9 miles to be graded and road-mixed surfacing placed thereon. District III, Routes 768, 769, 770. Claude C. Wood Co., Lodi, $153,845; Fredrickson & Watson Construction Co., Oakland, $159,039; A. R. McEwen & C. M. Syar, Vallejo, $175,-976; A. Teichert & Son, Inc., Sacramento, $186,900; W. C. Railing, Redwood City, $198,-336. Contract awarded to H. Earl Parker, Inc., Marysville, $142,869.40.

RIVERSIDE COUNTY—Near Cathedral City, two dips to be constructed and surfaced with plant-mixed surfacing. District VIII, Route 187, Section C. E. L. Yeager, Riverside, $6,451; Herz Paving Co., San Bernardino, $7,712; Cee Tee Construction Corp., Puente, $7,259; R. A. Erwin, Colton, $6,918; Matich Bros., Colton, $9,172. Contract awarded to R. P. Shea Co., Indio, $6,268.20.

SACRAMENTO COUNTY—On Howe Avenue, between Arden Way and State Highway Route 3, about 1.9 miles to be graded and surfaced with armor coat and crusher run base on imported borrow. District III, Route 937. A. Teichert & Son, Inc., Sacramento, $69,972; McGillivray Construction Co., Sacramento, $71,169; Brighton Sand and Gravel Co., Sacramento, $73,634. Contract awarded to George E. France, Visalia, $65,247.60.

SACRAMENTO COUNTY — Dismantling two quonset buildings located at Camp Parks near Livermore, transporting material therefrom to Sacramento and reconstructing one quonset building. District III. Wilkins Draying Co., Sacramento, $11,490; William B. Willett Company, San Francisco, $10,115; Dave L. Sills, Sacramento, $12,424; H. V. Cross Inc., Moutain View, $11,905. Contract awarded to Sutter Construction Co., Sacramento, $8,398.31.

SAN BERNARDINO COUNTY — On Bloomington Avenue, between Riverside Avenue and Colton Avenue, about 2.1 miles to be graded and surfaced with plant-mixed surfacing. District VIII, Route 706. Geo. Herz & Co., San Bernardino, $54,469; Matich Bros., Colton, $54,628; E. L. Yeager, Riverside, $54,-713; Griffith Co., Los Angeles, $55,793; Oswald Bros., Los Angeles, $59,199; Cee Tee Construction Co., Puente, $66,381. Contract awarded to T. M. Page, Monrovia, $52,960.40.

SAN DIEGO COUNTY—Furnish and install traffic signal system at 11th Avenue and A Street in City of San Diego. District XI, Route 77. California Electric Works, San Diego, $12,500; Ets-Hokin & Galvin, San Diego, $13,830. Contract awarded to Tri-Cities Electric Service, Oceanside, $9,507.

SAN DIEGO COUNTY—Between Escondido and 3.4 miles south of Riverside County line, a distance of about 19.6 miles, to be surfaced with plant-mixed surfacing. District XI, Route 77, Sections F, G. R. E. Hazard Contracting Co., San Diego, $205,783; Griffith Co., Los Angeles, $216,913; Daley Corporation, San Diego, $226,453; Basich Bros. Construction Co. and Basich Brothers, Alhambra, $235,215; A. Teichert & Son, Inc., Sacramento, $244,190; United Concrete Pipe Corp. & Jesse S. Smith, Baldwin Park, $244,515; Peter Keiwit Sons' Co., Arcadia, $247,140; Dimmitt & Taylor, Los Angeles, $252,912; MacDonald & Kruse & Hensler Construction Corp., Glendale, $254,750; Silva & Hill Construction Co., Los Angeles, $279,565; Warren Southwest, Inc., Los Angeles, $281,487; Haddock Engineers, Ltd., Oceanside, $285,892; Herz Paving Co., San Bernardino, $293,131; V. R. Dennis Construction Co., San Diego, $320,439. Contract awarded to Morrison-Knudsen Co., Inc., San Francisco, $203,180.

SAN JOAQUIN COUNTY—Between Calaveras River and Lodi, furnishing and installing concrete barrier posts and metal plate guard railing at various locations. District X, Route 4, Section C. Evans Construction Co., Berkeley, $27,378; George Von KleinSmid, Bakersfield, $30,111; Westbrook & Pope, Sacramento, $31,672; C. J. B. Construction Co., Oxnard, $36,765; Claude C. Wood Co., Lodi, $37,257; A. Teichert & Son, Inc., Sacramento, $38,884; Fredrickson & Watson Construction Co., Oakland, $39,730; M. J. B. Construction Co., Stockton, $41,400; S. C. Giles and Co., Stockton, $47,136. Contract awarded to F. Kaus, Stockton, $24,120.

SAN LUIS OBISPO COUNTY—At California Polytechnic School, about 2.7 miles to be graded and plant-mixed surfacing placed on imported borrow. District V. Madonna Construction Co., San Luis Obispo, $52,127; Granite Construction Company, Watsonville, $53,937; Ted F. Baun, Fresno, $54,639. Contract awarded to Brown-Doko, Pismo Beach, $46,760.50.

SAN MATEO COUNTY—In Burlingame on El Camino Real, between Rosedale Avenue and Primrose Road, furnishing and installing fixed time traffic signal systems at 10 intersections. District IV, Route 2, Section A, Burl. Abbett Electric Co., San Francisco, $40,207; H. S. Tittle Company, San Francisco, $40,-541; H. C. Reid Company, San Francisco, $51,460; L. H. Leonardi Electric Construction Co., San Rafael, $54,581. Contract awarded to Severin Electric Co., San Francisco, $37,-665.41.

SAN MATEO COUNTY—Between North City Limits of South San Francisco and 0.35

mile south of Colma Creek, about 2.1 miles to be graded and paved with portland cement concrete, asphalt concrete and plant-mixed surfacing on crusher run base and a steel stringer highway overcrossing and reinforced concrete pedestrian overcrossing to be constructed. District IV, Route 68. Frederickson & Watson Construction Co., Inc., Oakland, $971,251; Chas. L. Harney, Inc., San Francisco, $993,344; Granite Construction Co., Watsonville, $1,076,522; Morrison-Knudsen Company, Inc., San Francisco, $1,121,971. Contract awarded to Guy F. Atkinson Co., South San Francisco, $962,631.50.

SAN MATEO COUNTY—On Bayshore Freeway, between South San Francisco and Burlingame, superstructures and approaches for four overcrossings to be constructed. District IV, Route 68. J. H. Pomeroy & Co. Inc., San Francisco, $1,023,871; Charles L. Harney & A. Soda & Son, San Francisco, $1,015,897; M & K Corp., San Francisco, $1,059,999; L. E. Dixon Company, San Gabriel, $1,082,376; Guy F. Atkinson Co., South San Francisco, $1,085,891; Peter Kiewit Sons' Co., San Francisco, $1,091,816; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $1,287,192. Contract awarded to Carrieo & Gautier, San Francisco, $989,150.

SANTA BARBARA COUNTY—Over the tracks of the Southern Pacific Company at Salsipuedes Street in the City of Santa Barbara, the superstructure for an overhead crossing to be constructed. District V, Route 2. J. H. Pomeroy & Co., Inc., San Francisco, $533,308; Haddock-Engineers Ltd., Oceanside, $542,761; Earl W. Hiple, San Jose, $551,127; L. E. Dixon Co., San Gabriel, $553,581; Macco Corporation, Clearwater, $558,011; H. B. Nicholson, Pasadena, $561,721; The Contracting Engineers Company, Los Angeles, $578,562; A. Teichert & Son, Inc., Sacramento, $583,481; Dimmitt & Taylor, Los Angeles, $594,243; Carlo Bongiovanni, Los Angeles, $607,504; Sharp & Fellows Contracting Co., Los Angeles, $621,405; N. M. Ball Sons, Berkeley, $635,793. Contract awarded to Carl N. Swenson Co., Inc., San Jose, $527,522.45.

SANTA CLARA COUNTY—On San Jose-Stevens Creek Road between Saratoga Avenue and Cupertino, about 3.5 miles to be graded and surfaced with plant-mixed surfacing, and existing bridges to be widened. District IV, Route 1000. Leo F. Piazza, San Jose, $215,689; Fredrickson Bros., Emeryville, $249,730. Contract awarded to A. J. Raisch Paving Company, San Jose, $182,646.14.

SISKIYOU COUNTY—At Bear Creek about one-fourth mile south of Station 1239, Furnishing and stockpiling mineral aggregate. District II, Route 83, Section A. Contract awarded to McCoy & Butler, Yuba City, $11,250.

SONOMA COUNTY—About 0.5 mile east of the junction of Route 56 and the county road to Annapolis, mineral aggregates to be furnished and stockpiled. District IV, Route 56, Section E. Contract awarded to Arthur B. Siri, Santa Rosa, $13,475.

TEHAMA COUNTY—About 15 miles west of Red Bluff, the existing bridge across South Fork Cottonwood Creek to be repaired. District II, Route 29, Section E. Barton & Anderson, Oakland, $11,651; Liston Ehorn, Red Bluff, $12,275; C. C. Gildersleeve, Douglas City, $12,469; Evans Construction Co., Berkeley, $12,755; Bos Construction Co., Oakland, $13,422; T. A. Kvale, Ojai, $14,440; Westbrook & Pope, Sacramento, $14,525; Litchfield Construction Co., San Rafael, $16,645; S. C. Giles & Co., Stockton, $30,803. Contract awarded to C. M. Allen, Fairfield, $10,355.

September, 1947

ALAMEDA COUNTY—In the City of Oakland at the San Francisco-Oakland Bay Bridge Toll Plaza, about 0.6 mile, sand fill to be constructed. District IV, Route 5. Johnson Western Co., Alameda, $311,884; Construction Aggregates Corp., San Francisco, $322,500. Contract awarded to S. F. Bridge Co., San Francisco, $270,100.

ALAMEDA COUNTY—In the City of Oakland, at the San Francisco-Oakland Bay Bridge Toll Plaza, about 0.6 mile, rock slope protection and drainage facilities to be constructed. District IV, Route 5. Macco Corporation, Clearwater, $197,905; Chas. L. Harney, Inc., San Francisco, $235,614; Healy Tibbitts Construction Co., San Francisco., $238,150; Lee J. Immel, San Pablo, $241,486. Contract awarded to Piombo Construction Co., San Francisco, $181,806.50.

COLUSA COUNTY—Between Route 7 and Williams (Myers and Zumwalt Roads) and between Stone Corral Creek and Route 7 (McDermott & Lenechan Roads), a net length of about 8.6 miles, existing roadbed to be reshaped, imported borrow to be placed, penetration treatment and seal coat to be applied and a reinforced concrete slab bridge to be constructed across Stone Corral Creek. District III, Routes 1033, 1035, 1036. Jensen & Pitts, San Rafael, $83,085; A. Teichert & Son, Inc., Sacramento, $89,709; Harms Bros., Sacramento, $93,933; W. C. Railing, Redwood City, $95,018; Rice Bros., Marysville, $96,243; Johnston Rock Co., Stockton, $97,438; H. Earl Parker, Inc., Marysville, $99,473; H. & D. Construction Co., San Anselmo, $99,563; Edmondson & Miller, Sacramento, $109,000; J. Henry Harris, Berkeley, $109,085. Contract awarded to Fredericksen & Kasler, Sacramento, $78,421.

FRESNO COUNTY—Across Helm and Colony Canals, between 2 and 6 miles north of Firebaugh, two reinforced concrete slab bridges to be constructed. District VI, Route 41, Section M. Charles MacClosky Co., San Francisco, $47,743; G. M. Carr & Bati Rocca, Santa Rosa, $49,163. Contract awarded to E. G. Perham, Los Angeles, $41,909.50.

GLENN COUNTY—Across Sacramento River and East Branch of Rasor Slough near Butte City, portions of the superstructures of two bridges to be constructed. District III, Route 45, Sections B,C. A. Soda & Son, Oakland, $261,073; Frederickson & Watson Construction Co., Oakland, $268,685; Stolte, Inc., Oakland, $273,804; Carl N. Swenson Co., Inc., San Jose, $278,189. Contract awarded to Judson Pacific-Murphy Corp., Emeryville, $228,990.32.

HUMBOLDT COUNTY—Across South Fork of Eel River, near Redway, repairs to the steel bridge. District I, Whittemore State Park. Judson Pacific-Murphy Corp., Emeryville, $50,788; Butte Construction Co., San Francisco, $62,127; S. C. Giles and Co., Stockton, $66,585. Contract awarded to Reed & Tuttle, Redwood Valley, $39,580.

HUMBOLDT AND DEL NORTE COUNTIES—Repairing members of three steel truss highway bridges across Eel River, Yager Creek, and Smith River. District I. Routes 1,35,1. Sections E,A,C. Eureka Boiler Works & Acme Foundry Co., Eureka, $6,400. Contract awarded to C. E. Johnson, Eureka, $3,750.

HUMBOLDT COUNTY—Across and adjacent to Klamath River, at Weitchpec, a steel bridge superstructure to be constructed; about 0.3 mile of approaches to be graded and surfaced with imported base material; and about 0.6 mile of approaches to be sealed with a Class "C-Double" seal coat. District I, Routes 84,46; Sections B,CD. J. H. Pomeroy & Co. Inc., San Francisco, $428,272. Contract awarded to Guy F. Atkinson Co., South San Francisco, $347,355.

IMPERIAL COUNTY—Between Trifolium Canal and 2 miles north of Sandy Beach Road, a net distance of about 15.1 miles, portions to be graded, bituminous surface treatment to be applied, plant-mixed surfacing to be placed over existing surfacing and new base, and bridges to be constructed. District XI, Route 26, Sections A,B,C. MacDonald & Kruse and Hensler Construction Corp., Glendale, $497,012; Morrison-Knudsen Co., Inc., San Francisco, $529,285; R. P. Shea Construction Co., Indio, $542,393; Dimmitt & Taylor, Los Angeles, $551,228; Griffith Co., Los Angeles, $623,339; Peter Kiewit Sons Co., Arcadia, $629,019; Basich Bros. Construction Co. & Basich Bros., Alhambra, $678,965; R. E. Hazard Contracting Co., San Diego, $712,967. Contract awarded to R. A. Erwin & Cee Tee Construction Co., Puente, $419,275.95.

IMPERIAL COUNTY—At points between Grays Well and Winterhaven, 12 timber bridges to be repaired. District XI, Route 27, Section B. E. S. and N. S. Johnson, Contractors, Fullerton, $36,866; Walter H. Barber, La Mesa, $41,687; Catalina Construction Co., Covina, $49,847; C. J. B. Construction Co., Oxnard, $52,254; Thorsten & Dahl, Santa Monica, $57,951. Contract awarded to C. B. Tuttle Co., Long Beach, $35,774.50.

INYO COUNTY—Between Laws and Mono County line, 2.5 miles of fence to be constructed. District IX, Route 76, Section A. Contract awarded to Bishop Engineering & Construction Co., Bishop, $4,757.90.

INYO COUNTY—On Pine Creek Road near Bishop and on Glacier Lodge Road near Big Pine, a net distance of about 4.2 miles in length to be graded, bituminous surface treatment and penetration treatment to be applied and two timber culverts to be constructed. District IX, Routes 1071 and 1069. Arthur A. Johnson, Laguna Beach, $78,907; Dix-Syl Construction Co., Inc., Bakersfield, $90,078; Browne & Krull, Palto Alto, $103,280; Macco Corp., Clearwater, $110,374. Contract awarded to Westbrook & Pope, Sacramento, $76,074.30.

LOS ANGELES COUNTY—On Arroyo Seco Parkway, between Bernard Street and Avenue 22, about 1.2 miles to be planted. District VII, Route 165. Henry C. Soto & Co., San Pedro, $19,194; Jannoch Nurseries, Altadena, $21,139. Contract awarded to Huettig & Schromm, Palo Alto, $15,871.50.

MONTEREY COUNTY—Over the tracks of the Southern Pacific Company, on Sanborn Road, about 2 miles southeast of Salinas, a steel beam span overhead crossing to be constructed. District V, Route 108A. Granite Construction Co., Watsonville, $186,573; Earl W. Hople, San Jose, $188,235; Carl N. Swenson Co., Inc., San Jose, $189,943; Charles MacClosky Co., San Francisco, $204,094; Peter Kiewit Sons Co., San Francisco, $233,050. Contract awarded to Dan Caputo, San Jose, $183,527.50.

MARIPOSA COUNTY—At points between about 17 miles west of Mariposa and about 12 miles east of Mariposa, six bridges to be constructed. District X, Routes 966 and 963. Carl N. Swenson Co., Inc., San Jose, $95,343; Dan Caputo, San Jose, $98,942; G. M. Carr & Bati Rocca, Santa Rosa, $104,710; S. C. Giles & Co., Stockton, $108,601; C. J. B. Construction Co., Oxnard, $147,662. Contract awarded to E. H. Peterson & Son, Richmond, $83,826.

SHASTA COUNTY—Across Sacramento River at Redding and across Pit River, about 15 miles north of Redding. District II, Route 3, Section B. Contract awarded to J. H. Mohr, Inc., San Francisco, $10,314.



Director of Public Works C. H. Purcell of California shakes hands with Governor Vail Pittman of Nevada at dedication of Meyers Grade project. Frank Globin, President of South Tahoe Improvement Association, on left

Projects on U. S. Route 40 and U. S. Route 50

(Continued from page 18)

distances adequate for necessary passing zones. Work on this project was started in March, 1946, and was completed in March, 1947, at a cost of approximately $520,000. The contractor was H. Earl Parker of Marysville and the Public Roads Administration Resident Engineer was H. T. Gunderson.

RIBBON CUTTING CEREMONY

Officials and motorists of California and Nevada joined on September 13th in celebrating at Bijou, Lake Tahoe, the completion of the Meyers Grade section on U. S. 50.

Governor Vail Pittman of Nevada, Director of Public Works C. H. Purcell of California, representing Governor Earl Warren, E. C. Brown, District Engineer of the U. S. Public Roads Administration, and Congressman Clair Engle participated in ribbon cutting ceremonies.

The celebration was staged by the South Tahoe Improvement Association of which Frank Globin is president. Alan Bible, Attorney General of Nevada, was master of ceremony. The festivities were concluded with a barbecue attended by several thousand persons.

MEYERS GRADE IMPROVED

Opening to traffic of the Meyers Grade project represented completion of a five-mile relocation started in 1936. During the years 1936 to 1939 the upper 2.3-mile portion of the relocation was completed, but this still required that traffic use the major portion of the old road which had a minimum width of 16 feet, curves of 40-foot radius and grades up to 15 percent.

In the summer of 1941 a contract for grading and plantmix bituminous surfacing on the lower 2.7-mile section was awarded by Public Roads Administration to Johnson Rock Company, Inc., of Stockton, but more vital war work made termination of this contract necessary late in 1942, with only a small portion of the contemplated work completed. In December, 1945, a contract for completion of the project

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Colorful Ceremonies Mark Dedication of New Highway

(Continued from page 5)

Commission; Fred J. Grumm, Assistant State Highway Engineer; and others. Director Purcell spoke for Governor Warren.

PURCELL SPEAKS FOR GOVERNOR

Purcell said, in part:

"Governor Warren had hoped to be present today and celebrate, with you, completion of the first major postwar project in your Redwood Empire. Other important duties in connection with State Government prevented his presence, however, and he has asked me to express his sincere regrets and to tell you that he was extremely sorry that he could not be here.

"The Governor has a keen interest in providing highway facilities adequate to serve all of California. He has been successful in obtaining legislation which will provide increased revenues for necessary construction.

"These increased revenues will make it possible to continue modernization such as the highway you see here today. The California Highway Commission and the Division of Highways of the Department of Public Works believe that this newly completed project is an example of the type of facility needed to advance the economy of the State.

LEGISLATURE INCREASES REVENUES

"It is a step toward providing a greater convenience to the motoring public and to advance the economy of your magnificent Redwood Empire by providing an impetus for increased commerce between this and other generously productive areas.

"With the signing by Governor Earl Warren of the Collier-Burns Highway Act, enacted by the Legislature in the closing hours of its 1947 Session, the Division of Highways is assured of an average of approximately $76,000,000 annually for the next 10 years for new state highway construction.

"For the current year of July 1, 1947, to June 30, 1948, new revenue for right of way, construction engineering, and construction will amount to 17 million dollars over and above amounts provided by previous legis-

lation. With this added 17 million, the amount allocated to the southern group of counties will total 27 million dollars, and to the northern group of counties 24 million dollars.

"You may be sure that action will be taken to correct highway deficiencies in Marin and Sonoma Counties, as well as in the balance of the Redwood Empire, as fast as funds become available for allotment to the most critical proposed projects. Improvements such as this do not 'just happen.' They result from prudent consideration of the present and future needs. They represent a lot of planning and a great amount of energy spent by civic-minded groups and individuals.

"I want to give credit where credit is due. It is with deep sorrow that I miss an old familiar face here today. The passing of Senator Herbert Slater has taken a friend of yours, and mine. He was an able champion in many fields of public improvement, not the least of which was the development of streets and highways.

"The late Senator Slater and business and civic leaders up here, including members of the Redwood Empire Association, have been most cooperative by demonstrating wisdom and foresight in keeping the commission fully appraised of your highway needs. Their combined efforts are partly reflected in the expanded service facility provided by this new highway, which, along with other important future improvements, will greatly affect the economy and growth of California's Redwood Empire."

A band, roving musicians, costumed girls from Novato, Petaluma, and San Rafael, and Novato riders, added color to the celebration, which was directed by Clyde Edmondson, General Manager of the Redwood Empire Association. Following the dedication, the official guests proceeded to the New Hotel, Petaluma, for an informal buffet luncheon, provided by the Petaluma City Council, Petaluma Chamber of Commerce, and Redwood Empire Association.

New Feather River Bridge Between Marysville and Yuba City Dedicated



Official group at Marysville-Yuba City bridge dedication. Left to right, front row: Mayor Henry Johnson, Marysville; Assemblyman Bert Loomis, Chico; General R. E. Mittelstaedt; Senator W. P. Rich; Highway Commissioner Harrison R. Baker; Deputy Public Works Director A. H. Henderson; State Highway Engineer George T. McCoy; District Engineer C. H. Whitmore, Marysville; Bridge Engineer F. W. Panhorst. Back row: Second from end, left to right, Chairman E. F. DaCosse, Sutter Board of Supervisors; Supervisor Carl Hamon, Marysville; Chairman James P. Brown, Yuba Board of Supervisors; City Councilman Howard Harter, Yuba City; District Attorney Roy Hewitt of Marysville; Highway Commissioner Chester H. Warlow, Fresno; Highway Commissioner Walter Sandelin, Ukiah; Jules E. Gerhardt, Chico; Hugo Del Pero, Yuba City; Lester Rice, Marysville; "Doc" Rice, Marysville; Keith Kenyon, Secretary, Sutter Chamber of Commerce

(Continued from page 22)

"Today we stand upon this new bridge, five blocks upstream and 40 years further along in the history and development of California, to dedicate this modern structure.

"This new bridge is approximately one-half mile long and represents a total cost, together with the approaches, of about $3,000,000. Built to carry four 12-foot traffic lanes, two in each direction, separated by a four-foot safety division strip in the center, the State considers it one of the most modern structures on the State Highway System and feels that it is an important asset not only to this section of California but also to the entire state system.

"We know what it means *now* to the cities of Marysville and Yuba City and to Sutter and Yuba Counties to have a modern bridge facility which will expedite the flow of through traffic. But it should give you greater satisfaction to know that this new improvement was not engineered just for the current traffic of some 22,000 vehicles per day. It is expected that by 1965 the traffic will have increased to about 37,000 vehicles per day and that this new construction will provide adequately for many years beyond that date."



This is another view of intersection of Highway 17 and Niles Canyon Road, showing adequate traffic warning signs

Projects on U. S. Route 40 and U. S. Route 50

(Continued from Page 30)

was awarded to the E. W. Elliott Construction Company of San Francisco. Actual contract work was not started until June, 1946, because of snow conditions. Work continued, except for the 1946-1947 winter shutdown, until completion in September, 1947. The cost of the Elliott contract was approximately $275,000. The Public Roads Administration Resident Engineer on the work was H. L. Clausen.

Final cost of the entire five-mile relocation was approximately $750,000.

Engineers Must Have Help of Motorists To Combat Accidents

(Continued from page 9)

highways shows that by their own admission 94 percent of drivers involved were familiar with the highway at that point through previous use. It was not that they did not know but that they did not appreciate and perform up to their responsibility to themselves and others which they must necessarily accept when they drive. Your assistance in keeping this truth uppermost in the minds of highway users can be of outstanding benefit, and I earnestly bespeak your cooperation toward this end.

HIGHWAY DEFICIENCIES

The work of the recent Legislature, with its exhaustive study of the entire highway situation throughout the State, is, of course, well known to you as to all other informed citizens. From it you know that there are now on the State Highway System alone deficiencies which measured in dollars and cents amount in round numbers to 1.5 billion dollars. The revenues from present sources, at the rates now established, which will become available to correct these deficiencies are estimated to average about 76 million dollars per year over the next 10 years. It is apparent from this that all of the work which should be done cannot be done within any short period of time.

The Division of Highways as a part of its construction activities carries on a continuous program of traffic signal installations with first consideration necessarily being given to the most acutely congested intersections. Traffic control devices other than traffic signals are installed at all important intersections on the State Highway System. We have no fixed or inflexible criteria for the warrant of signals. Traffic volume is, of course, a paramount consideration. However, the accident history is in every instance also given careful study. In this connection it must be pointed out that any particular total number of accidents which have occurred at an intersection does not necessarily mean that traffic signals are warranted or even altogether desirable. Instances could be cited where the introduction of signals has increased the accident occurrence. And I am sure you would agree that the wholesale indiscriminate installation of signals would not only be an unwise expenditure of limited highway funds but would seriously and needlessly hamper the free movement of traffic in general, a condition directly the reverse of the basic reason for the investment of public funds in highway facilities.

APPRAISING ACCIDENTS

In appraising the accident records it is apparent that the aim must be to determine from the evidence they contain which ones of these would in reasonable probability have been prevented had signals been in place. Only such deserve any serious consideration. In the event an appreciable number are revealed by this study, their seriousness must still be weighed against a like reasonable probability that if signals were installed they might occasion another type of accident. Here we would mention the frequent increase in the rear-end type of accidents which result where signals are introduced against heavy volumes of relatively high speed traffic.

There are, as you know, literally thousands of highway intersections at grade on the State Highway System, and any program calling for even the most modest improvement of them must necessarily require in total a very large expenditure. And this in turn represents but a minor percentage of the over-all deficiencies which require improvement. Consequently, the Division of Highways can logically have but one policy, which is that such funds as are available be allocated and expended so as to obtain the maximum in traffic service per dollar expended and to spend each dollar where it should be spent; in other words, to do those things first which should be done first and to do these in a workmanlike manner.

For this rather lengthy and detailed exposition of certain policies and practices which are followed by this division I ask your indulgence. It has been made with the thought and sincere desire that through fuller understanding of all the elements which are involved, the highway user may be made to recognize and, most important of all, to accept the fact that if he so wills he has within himself more ability and power to reduce the highway accident toll than all other means combined, even to the point of its practical elimination. The Division of Highways will continue its best efforts to assist him in this accomplishment.

Yours very truly

G. T. McCOY

State Highway Engineer

State of California

EARL WARREN, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



NOVEMBER - DECEMBER
1947

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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Photo by Merritt R. Nickerson, Public Works Department Photographer

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Two New San Francisco Bay Crossings Are Given Approval by the Governor And the California Toll Bridge Authority

THE STATE Department of Public Works, after studying the San Francisco Bay traffic problem and all available crossing sites for two years, has determined that if the needs of the region are to be fully served, it will be necessary to construct two additional bay crossings in the near future—one in close proximity to the present San Francisco-Oakland Bay Bridge, and the other from the neighborhood of Army Street in San Francisco to Alameda—a so-called southern crossing.

The California Toll Bridge Authority with the emphatic support of Governor Earl Warren, its chairman, on November 10 concurred in this decision.

The order in which these crossings are to be constructed must depend upon facts yet to be determined, particularly with relation to their cost including approaches, the length of time necessary to construct, their ability to relieve present traffic congestion, as well as serve the needs of the future, and the problems of financing through revenue bonds.

In order to be certain that rights-of-way for these crossings will not be encroached upon and thus involve unnecessary expense and waste in the future, it is essential that both rights-of-way be now determined and the necessary action taken to protect them from such encroachment.

TO HOLD PUBLIC HEARINGS

The Department of Public Works will continue its activities to determine the essential facts with relation to both crossings. When these factors are determined, and before deciding the priority of construction, the California Toll Bridge Authority will hold public hearings in which interested persons and public agencies will be invited to testify in the light of the established facts.

In this way the solution of the very serious San Francisco Bay traffic problem can proceed in an orderly manner without delay.

The authority took action after hearing the report of Director of Public Works C. H. Purcell, which follows:

"To the California Toll Bridge
Authority
Sacramento, California

"Gentlemen:

"Pursuant to the resolution of the California Toll Bridge Authority, adopted October 30, 1945, requesting, authorizing and directing the Department of Public Works to proceed to make a comprehensive engineering investigation and study of the need for an additional bridge across San Francisco Bay, and providing that such study include consideration of the financial requirements for such a bridge, the Department of Public Works of the State of California herewith formally presents to the California Toll Bridge Authority the report entitled 'Preliminary Studies for an Additional Bridge Across San Francisco Bay,' dated January 31, 1947.

"The report contains studies and investigations made by the Department for crossings at 12 separate locations.

"Upon consideration of the information developed by this study, and subsequent thereto, the Department of Public Works is of the opinion that two additional crossings of the Bay of San Francisco from the City and County of San Francisco to the County of Alameda are required; that such crossings constitute necessary and essential links in the public highways of the State, and that it is for the best interests of the public highways in the State that such additional crossings be constructed and operated by the State of California.

"In view of improvements presently under way, and anticipated in the future, within the right of way which necessarily must be occupied by these crossings, their appurtenances and approaches, the Department of Public Works is of the further opinion that it is in the public interest that action be taken at this time.

RECOMMENDATIONS

"The Department of Public Works recommends (a) that one of such crossings should be a toll bridge on a line between Rincon Hill, in the City and County of San Francisco, and the City of Oakland, via Yerba Buena Island, approximately parallel to, and northerly of, the existing San Francisco-Oakland Bay Bridge, together with tube under the Oakland Estuary with connections to the East Bayshore Freeway and the City of Alameda; and (b) that the other of such crossings should be a toll highway crossing on a line from the Bayshore Freeway in the vicinity of Army Street, in the City and County of San Francisco, across the Bay of San Francisco, to the southerly limits of the City of Alameda; thence northerly in the vicinity of Fifth Street to and including a crossing of the Oakland Estuary to a connection with the East Bayshore Freeway, in the City of Oakland, County of Alameda; together with necessary appurtenances and approaches for both such crossings.

"Preliminary estimates of the cost of such additional bridge, based on studies by the Department of Public Works, is $105,000,000, and of the cost of such additional highway crossing, based on estimates contained in the report of the Joint Army-Navy Board, is $134,468,000, a total of $239,468,000.

"The amount required to be raised for the purpose of retiring outstanding bonds and the indebtedness to the State Highway Fund secured by a pledge of the tolls and revenues of the existing San Francisco-Oakland Bay Bridge is constantly decreasing, and the amount which will be required for such purposes will have to be determined at the time of the authorization of any bond issue. Facts respecting outstanding bonds and the application of estimated revenues of the existing bridge to bond redemption are set forth in the attached tabulation of bond service.

(Continued on page 36)



General view of the Coyote scale in Santa Clara County. A load of tomatoes is on scale. Two vehicles in left background are preparing to unload a portion of excess load

The Overload Problem on Highways

By BLAIR GEDDES, District Traffic Engineer—Administration

CALIFORNIA is faced with a problem of considerable magnitude because of a combination of factors. Much of the State's development has occurred since the advent of the motor vehicle resulting in an unusual dependence on highway transportation. Three-fourths of the entire area of the State is in rolling hills, foothills and rugged mountains. The communities in these areas are limited in size and usually separated by considerable distance.

The geographic and topographic conditions are not conducive to the construction of rail and water transportation which has been such a factor in the development of many of our eastern and central states. One-third of the communities in California have no form of transportation except highways.

The primary means of transport and intercommunication in California is so dependent upon highways that the development and economy of the State are irrevocably geared to highway use. In 1940, the last census year, California had one motor vehicle per 2.49 persons as compared to a national average of one motor vehicle per 4.1 persons. During the war years with the limitation of vehicle manufacture for public distribution, these figures dropped to one vehicle per 3.11 persons in California compared to the figure of 4.6 for a national average in 1945.

TRUCK TRAFFIC HIGH

In 1945 California had 9 percent of all motor vehicles in the United States which consisted of 2,853,177 motor vehicles upon which registration fees were paid. These were divided into 2,604,789 automobiles and 248,388 trucks. Figures are not completely available as to the weight and capacity of these registered truck units but the 1941 inventory of the Public Roads Administration showed that while California listed a total of 7½ percent of all trucks and truck tractors of over 1½ tons capacity it had 15.6 percent of the inventoried units in the 15-22½-ton class. In addition, California had 34 percent of all inventoried trailers over 1½ ton capacity and 7 percent of all semitrailers with 29 percent of the 15- to 22½-ton class.

The preponderance of heavy trucks and semitrailers and the large number of full trailers in California is an indication of the dependence of the State on motor truck transportation. The truck allocations to California during the war by the Office of Defense Transportation indicates that a high percentage of the heavier types were placed in service which increased rather than diminished the volume of the heavy units.

A comparison of truck weights during 1944 in the United States fur-

ther accentuates the ratio of heavy trucking in California where the average weight of all loaded trucks and combinations was 23,470 pounds as compared to the national average of 18,439 pounds. Axle weights in California averaged 11,995 pounds as compared to the national average of 9,906 pounds. Ninety-five of every 1,000 trucks weighed in California grossed 50,000 pounds or over as compared with 19 out of every 1,000 for the United States average.

This high ratio of heavy trucking is the result of the realization of the dependence of the State on highway transportation and the resulting liberalization of restrictions and statutes which today are among the most liberal of all of the states with respect to height, width, length, and weight of vehicles allowed to operate on the public road system.

EQUIPMENT OVERLOADED

Despite these most liberal provisions, a certain proportion of the operators, either wilfully or thoughtlessly, overload their equipment in excess of the statutory limits. The control of these violations has, in the past, been inconsistent, and in some cases desultory for several reasons, the prime factor being inadequate or improperly located scales. Other factors have been a lukewarm support on the part of some of the courts, and a drastic shortage of manpower in the California Highway Patrol making it necessary to assign certain other duties to the regular Commercial Detail Officers which reduced the amount of time which could be devoted to the regular enforcement activity on commercial vehicles.

During the calendar year of 1940 the officers assigned to commercial work made 7,019 arrests for overloading. Of these, 3,003 citations were issued to 120 operators who accounted for 10 or more violations each which were segregated as follows:

100 or more arrests	3
50 to 100 arrests	9
25 to 50 arrests	20
15 to 25 arrests	34
10 to 14 arrests	54
	120

Of the above 120 repeaters, the 66 who were apprehended 15 or more times accounted for 2,379 of the violations, for which they were assessed an average of $9.70 per violation.

During 1945 overload citations numbered 2,730 for miscellaneous and 45 log and lumber trucks. In 1946 incomplete records show that this was increased to 6,052 miscellaneous and 806 log trucks for a total of 6,856 citations.

The 1946 repeater citations were as follows:

100 or more arrests	3
50 to 100 arrests	6
25 to 50 arrests	14
15 to 25 arrests	25
10 to 14 arrests	23
	69

The total arrests and the number of repeater citations would have, in all probability, been higher than in 1940 except that two checking points, namely Burlingame and Madrone, were not in operation during the entire year. The state-owned scales at Burlingame were removed at midyear to accommodate the expansion of the Bay Shore Highway to a freeway and have not been reinstalled. Due to an ownership change of the winery at Madrone, the private scales at this location were withdrawn from use by the Patrol during the last four months of the year. As these two locations accounted for over 34 percent of the repeater citations in 1940, the inoperative period has caused a large reduction in citations which might lead to the conclusion that conditions have improved when the reverse is true.

The enormity of the problem can be realized when a review of the amount of the overloads is seen. The following tabulation covers the number of overloads cited during 1946, the first column listing the amount of the overload and not the gross load.

Pounds Overload	(1946) Lumber Gross	Lumber Axle	Misc. Gross	Misc. Axle	Total Gross	Total Axle
0- 2,000	35	66	854	1080	889	1146
2- 4,000	111	118	1310	1315	1421	1433
4- 6,000	56	99	486	355	542	585
6- 8,000	44	55	203	120	247	175
8-10,000	50	30	80	40	130	70
10-12,000	36	9	49	19	85	28
12-14,000	23	2	31	2	54	4
14-16,000	13	2	26	3	39	5
16-18,000	20	2	13		33	2
18-20,000	6	1	21		27	1
20-22,000	13		12		25	
22-24,000	4		9	1	13	1
24-26,000	2		3		5	
26-28,000	1		3		4	
28-30,000	1		8		9	
30-40,000	4		4	1	8	1
40-50,000	2		2		4	
50-60,000			1		1	
60-70,000	1				1	

As the structural design of our pavements is based on the number of 5,000-pound wheel loads anticipated during the first 10-year period of its life, and a 10,000-pound wheel load is equivalent to 32 5,000-pound wheel loads in the factors of determination, it is evident that the substantial overloads shown above constitute a problem which cannot be overlooked.

Measuring at Coyote to determine allowable gross weight. Note mast arm and height indication to right of flag pole



District IV has long been cognizant of these conditions and has advocated the installation of additional checking stations at strategic locations. In certain areas of the district, adequate enforcement is realized because of existing installations.

On U. S. 40 state-owned scales are located at Hercules and at the Carquinez Bridge. The Hercules scales are on the east side of the road and are used when commercial traffic is predominately northbound. When the truck traffic is predominately southbound the activity is transferred to the scales at the north end of the Carquinez Bridge where the scales are on the west side of the highway.

GOOD COVERAGE AT SOME POINTS

In Marin County both directions of travel are intercepted on the scales north of San Rafael. As no alternate routes are available good coverage is attainable at this location on U. S. 101. Such favorable conditions do not prevail in other sections of the district.

In the southern and eastern sections of Alameda County, privately-owned scales which are available for patrol use are not located on the highway and adequate coverage is impossible. The officers must intercept vehicles which appear to be heavily laden and escort them to the scales where they can be checked. This is a slow, tedious process and the results are unsatisfactory.

Reasonably good coverage was obtainable in southern Santa Clara County prior to the time that the privately-owned scales were withdrawn from use at the Madrone Winery; however, at all of the private scales there is either little or no room for parking.

FINES NOT DETERRENT

Because of the high percentage of consistent violators, it is increasingly evident that the fines assessed by the various courts have not been, of themselves, a sufficient deterrent to the malpractice of overloading. To supplement the citations, unloading of the excess is required before the vehicle is allowed to proceed. This policy was made effective in March of 1946 and between the effective date and the end of the calendar year a total of 7,417,489 pounds were caused to be unloaded. During the first six months of 1947, the unloaded poundage amounted to 4,951,407 pounds.

The process of unloading is in some cases a difficult problem, particularly with bulk goods or when the materials are of considerable value, in which event the vehicle must be parked until another truck can be called to remove a portion of the load. Where this occurs frequently, few scale installations have sufficient vacant area in the immediate neighborhood to accommodate the parked vehicles.



Truck-trailer combination being checked for gross weight and overall length at Carquinez Bridge scale

On September 18, 1947, a new installation was completed and put in operation at Coyote, some 10 miles south of San Jose on U. S. 101. At this particular point there are no alternate routes where vehicles can bypass the scale and every vehicle to and from the San Francisco Bay area to the southern part of the State via 101 must pass the scale.

Every effort has been made to provide the necessary facilities for rapid and efficient checking. The scale house has windows along the entire front and at each end. The scale platform is 10 feet x 30 feet with dial indication. The 80,000-pound dial is double faced and is set crosswise in the house so that it can be seen from either door. Illumination is provided for night weighing and, as an additional feature, an arm is mounted from the light standard extending over the scale platform from which is suspended a series of cords. These cords are successively 13 feet-6 inches; 14 feet-0 inches and 14 feet-6 inches above the scale platform and indicate, at a glance, the overall height of the vehicle and load.

AMPLE SPACE

Water and toilet facilities are provided within the scale house for the officers' use and electric heaters are built into the wall to provide heat during inclement weather. The area surrounding the scale where parking can be accommodated ranges from 50 feet to 150 feet in width and is approximately 2,000 long.

A similar installation on a slightly smaller scale is presently in progress on U. S. 50 approximately five miles east of Livermore in Alameda County. When this installation is completed, the major entries to the Bay area will be well controlled.

Under provisions of the California Vehicle Code, fines assessed for weight violations are turned over to the counties in which the violator is apprehended. Because all of the financial return is a county benefit it was felt that the counties should share in the installation costs. On both the Coyote and Livermore installations the respective counties were contacted and

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Upper—Freight truck and trailer being measured at Carquinez Bridge. Lower—Measuring length of tank truck and trailer at Hercules scale





Shasta-Schilling Highway Project Cuts Number of Curves From 72 to 7

By H. CLYDE AMESBURY, Construction Engineer
and DRURY ELDER, Resident Engineer

WHEN the recently improved Shasta-Schilling link of the Redding-Eureka highway was completed, the old town of Shasta once more observed an improvement in local transportation facilities, the factor that had been responsible for her lusty, boisterous youth, and had later led to her decay.

Shasta's location was determined by the Sacramento-Clear Creek divide. Topography permitted the freight wagons to drive up from the Sacramento Valley as far as this location. Beyond lay the rough, broken country that could only be traversed by pack trains. Naturally, a trading post developed at this spot. And what a trading post!

GOLD DISCOVERED

Gold was discovered and business boomed. In 1853 gold shipments averaged $100,000 a week, or $5,000,000 for the year. One merchant averaged over $10,000 a week in gold dust. The first Masonic Hall was built in this year to house the Western Star Lodge. This same year a half million dollar fire destroyed the whole business section.

Shasta was not dead. By 1855 there were 28 brick buildings with a cash value of a quarter of a million dollars. It was the county seat. The Empire Hotel was one of the finest between Sacramento and Portland. Bull, Baker & Company, whose faded name can still be deciphered on the front of some of the ruined buildings, was the largest wholesale firm in Northern California. Their pack trains went as far as Oregon. Sometimes there were a hundred freight wagons in town at one time. Shasta was a real camp. It had a population of several thousand.

Shastans preceded the efforts of Californians, Inc. by sending a group of men to Salt Lake to induce immigrant trains to come to Northern California by way of Beckwourth Pass.

Then, along in the seventies, the railroad came through Redding, seven miles to the east. At about the same time the pack trail to the west was widened to accommodate wagon traffic. Shasta's career was ended. Transportation conditions made her and transportation conditions ruined her.



Upper—Original Shasta County Court House at Shasta stands as landmark of pioneer days. Lower—Whiskeytown Hotel at Schilling, built in 1852

Shasta now rests on her past glories. People from Redding moved out there for housing accommodations but others have followed them for the real beauty and advantage of their surroundings.

It is now a quiet little family community.

The western end of the new highway improvement is just west of Schilling, but no Shastan ever calls it that. It is Whiskeytown. If the postal department decrees that mail for this community must be addressed to Schilling, that's that, but the residents live at Whiskeytown. Make no mistake about it.

WHISKEYTOWN FOUNDED 1849

Whiskeytown was founded in 1849. Rumor says a barrel of whiskey lost from a pack train in the little creek near the hotel created the name of Whiskey Creek and, hence, Whiskeytown. The adjacent stream is Brandy Creek so the explanation seems specious.

The old pack trail between these points was widened for wheel traffic in the 1870's. It was first improved as Camden's Toll Road and then taken over as a county road. This location was taken into the State Highway System in 1909; but the first improvement was performed in 1919. The road was graded and provided with a surface 20 feet in width. Grades were generally 5 percent with some stretches of 6.50 percent. The alignment generally followed the old county road; that is, it followed the contour into the gulches and around the hillsides. Sight distances were sometimes less than 100 feet

DEMAND FOR LUMBER

At that time, this was a very worthwhile improvement. However, highway standards advanced until the road built for 1919 traffic compared to modern requirements on about the same basis as automobiles and trucks of 1919 compared with our present-day units.

Then came the war and the demand for lumber. Some of the largest stands of virgin timber still in the State are in Trinity County. Logs and lumber from the saw mills began to stream over the highway. The curves were so short and loads so long that the trucks could not negotiate the road without crossing over the centerline. One native said he poked the radiator cap of his old Ford around the corners; if he didn't get hit, he followed with the rest of the car. It was a highly dangerous condition but, strangely enough, few accidents occurred. The danger was so evident that the users were careful.



Upper—New construction virtually took a straight swath through the original crooked alignment. Lower—Starting the deep fills required cooperative tugging and pushing on part of heavy equipment

In early 1945 delegations of citizens from Shasta and Trinity counties besought the Highway Commission to provide some relief for this highway. They pointed out that there were 2,400,000 MBM of badly needed timber in Trinity County. They called attention to the fact that busses loaded with California's most precious asset, her school children, negotiated this road daily.

SHASTA-SCHILLING PROJECT

The commission, impressed with the serious aspects of the situation, reallotted certain funds set aside for Shasta County projects and advanced the Shasta-Schilling project to construction in 1946. Bids were opened in August and the contract was awarded to N. M. Ball & Sons and Harms Bros.

Grading work was rushed all winter under the direction of Milne Simpson, General Superintendent for N. M. Ball & Sons, and Job Superintendent Andy Webster. The excavation contained much rock, and, contrary to expectations, slides developed on most of the larger cuts. This was cured by benching. The really difficult part of the work was taking care of the traffic. This had to be carried through construction because there was no other means of caring for it. The construction crossed the existing road 28 times.

Grading operations involved the handling of 558,000 cubic yards of roadway excavation. Grading was carried on very expeditionsly by means of 10 scrapers of 22- to 30-cubic yards capacity, and a Northwest "80" power shovel. Most of the work was performed on a two-shift basis; operating from 7 a.m. to 11 p.m.

Geologic formation through which the project passes shows evidence of ancient activity in the area. Materials encountered in grading operations were extremely variable in nature, ranging through loose earth; porphyry in various stages of disintegration; conglomerate earth and rock interspersed with frequent quartz and diorite intrusions.

Two miles of the project, over Shasta Divide, pass through a very unstable formation, in which deep cuts reach a maximum of 110 feet. Cuts were benched approximately half-way up the slope, and back-slopes were flattened in an effort to prevent future slides.

Embankments through this section reach a maximum of 120 feet below finished grade. Steep natural ground slopes presented many problems in pioneering the grading work. Starting of fills often required combinations of four tractors pushing and pulling to retrieve empty scrapers from the fill areas. Since most of the heavy grading interfered with the existing road, maintaining suitable conditions for traffic presented quite a complex problem.

The Schilling-Shasta area is noted for its abundance of springs. Frequently during grading operations, water seams were opened that carried free water sufficient to fill a pipe line one inch or more in size. To provide for proper subgrade drainage, systems of six-inch perforated metal pipe underdrains were installed. A total of 9,600 feet of underdrain was required, most of which was installed through wet cuts, with the line being situated parallel to centerline, adjacent to the shoulder on each side. Other interesting features of the drainage items were the erection of 105-inch and 180-inch field assembled plate culverts.

Harms Bros. put on the crushed rock surfacing and plant-mixed surfacing under Superintendent Jack Wilson.



Straight stretch of Shasta-Schilling highway

So now Shasta is again affected by highway improvement. In place of the old highway with its 72 curves and short sight distances, there now stretches a modern highway. Grades are limited to 7 percent and there are just seven long radius curves. The distance has been shortened .65 of a mile.

The citizens of Trinity County and western Shasta County, as well as sportsmen, vacationists and those engaged in lumber transportation, appreciate this improvement as only those people can who were forced to use the former highway with its steep grades, sharp curves and limited sight distances.

Deep cuts were benched to remove unstable material from above the highway



ASSOCIATED GENERAL CONTRACTORS ALLOTTED 100 AFFILIATED UNITS

THE ASSOCIATED General Contractors of America will sponsor 100 affiliated units in the Organized Reserve Corps, Lieutenant General R. A. Wheeler, Chief of Engineers, announced today.

The association was invited by the Department of the Army to sponsor the principal reserve construction units needed by the Army in its affiliation program, whereby reserve units are sponsored by civilian organizations performing functions closely allied to the units' projected military assignment.

The 100 units, which at their ultimate strength would comprise a total of approximately 45,000 officers and men, are the first to be allotted by the Corps of Engineers.

Orange County Completes Its First Federal Aid Secondary Highway Project

By HAROLD SPRENGER, Road Commissioner, Orange County

IT IS doubtful if a single county highway in Orange County serves a greater diversification of users than the recently completed federal aid secondary project known as Harbor Boulevard.

This, the first of five projects contemplated under the three-year Federal Aid Program, is 11 miles long reaching from Anaheim, in the northerly section of the county to Costa Mesa in the southerly coastal section. It passes through farmlands devoted to many varying types of agricultural activity ranging from the small "acre" places of the suburban family to the intensively cultivated orange orchards and truck farms, as well as the larger farm units specializing in lima beans, sugar beets and alfalfa.

Harbor Boulevard is, however, much more than a "farm to market" road. When it was originally improved by the county years ago it immediately came into use by local residents of the northern section of the county as an alternate route to beach areas. Furthermore, traffic originating outside the county seized upon the route as one affording easier driving conditions than the state highways which pass through heavily congested business areas. The traffic load quickly built up as soon as the old two lane highway was completed, ultimately reaching a count of 4,573 vehicles at the Bolsa Avenue intersection in October, 1945.



Looking northeast to 800-foot radius curve

ARTERIAL IMPORTANCE

Because of its arterial importance, Harbor Boulevard was given the No. 1 priority for the first postwar years construction under the Federal Aid Program. The type of improvement agreed upon by county, state and federal administrators was a three-lane traveled way, 33 feet in width, flanked by six-foot oiled shoulders. The old road had been improved from time to time and varied in type of construction and in width, consisting of concrete, armor coat on decomposed granite and plant-mix gravel from 16 feet to 30 feet in width. Because of its stable condition and bearing qualities, the old road provided an adequate base for the average three inch blanket course of plant-mix surfacing of the new improvement. In the preliminary studies, tests of the bearing quality of the widened roadway areas were made and on the basis of these tests, four combinations of base material were used:

(1) 6 inches of imported borrow overlaid with three inches of untreated rock base material.

(2) 12 inches of imported borrow overlaid with three inches of rock base material. (Untreated)

(3) 6 inches of untreated rock base material.

(4) 3 inches of untreated rock base material.

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This is another view looking north to 800-foot radius curve



State Using War Surplus Bridges

By H. D. STOVER, Senior Bridge Engineer

THE CALIFORNIA Division of Highways has found it economical to use surplus United States Army, portable steel highway bridges, fixed type, in permanent structures. To date one such bridge has been completed and a second is under contract.

Photographs 1 and 2 illustrate the completed Mill Crossing bridge on a service road across Lagunitas Creek in Samuel P. Taylor State Park, Marin County. The main span is an H-10 bridge 72 feet long, consisting of two structural steel box girders, made up of light angles welded to subdivided Warren trusses, and a timber deck. The girders were furnished in sections 12 feet long, the sections being bolted together with 1¼-inch bolts having a minimum yield point of 40,000 pounds per square inch. When assembled, the bridge has a truss depth of 4 feet and provides a single 10-foot clear roadway.

As built for the Army these bridges do not have railings. A steel railing was provided, consisting of a 6 x 4 x ⅜-inch angle top rail and a 4-inch, 5.4 pound channel intermediate rail supported on U frames made up of 6-inch, 12.5-pound I beams. The U frames were reinforced at the corners by ½-inch gusset plates and were welded to the top chords of the trusses.

Nailing strips were bolted to the top chords of the trusses and the 3-inch deck planks were nailed to them with two 5½-inch x $\frac{5}{16}$-inch double grip spikes.

The bolts connecting the lower chords of the girder sections were reinforced by welding a 3-inch x ½-inch x 1-foot 8-inch plate across the joint.

Figure 3 is the typical cross section of the bridge now under construction across Big Sur River in Pfeiffer Redwood State Park.

This bridge consists of two parallel, heavy type H-20 bridges 125 feet long with two 12-foot ramps making a total length of bridge of 149 feet and provides a two-lane divided highway with 10-foot clear roadways. The twin superstructure is supported on concrete piers and abutments. Each bridge is composed of two 2 feet x 6 feet steel box girders built in sections 12 feet 6 inches long, in which the trusses are of the double Warren type.

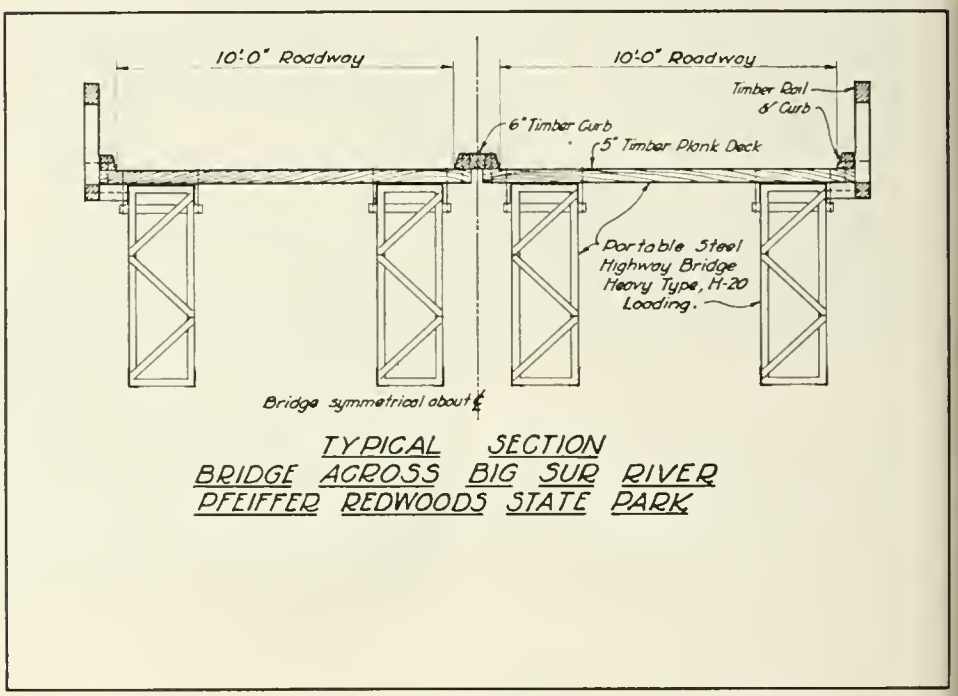


Figure 3

The girders are supported 12 feet 6 inches from each end, to give a 100-foot main span. The overhangs, plus the ramps, form the 24-foot 5-inch end spans. The launching rollers, furnished with the bridge, were modified to provide the bearing assemblies at the ends of the main span. This method of supporting the girders shortened the span and reduced the stresses in the lower chords so that it was not necessary to reinforce the bolted connections, as was done at Lagunitas Creek.

The deck planks were laid directly on the upper chords of the trusses and held in place by nailing each plank to the wheel guard with one ¾-inch x 9-inch spike and bolting to the trusses at approximately 6-foot centers, using the deck clamping beams furnished with the bridge.

A timber rail, adzed to give it a rustic appearance, was bolted to the outside wheel guards.

The Mill Crossing Bridge over Lagunitas Creek was so named because it is located at the site of a bridge built by Marin County in 1862 to provide better access to the paper mill. The only remaining portion of this early day bridge is the steel cylinder pier shown at the left in **Photo No. 1.**

This Pioneer Paper Mill, the first on the Pacific Coast, was built in 1856 by Samuel P. Taylor (1827-1886). Marin County records note that "the mill was built on land purchased from Rafael Garcia and situated on Paper Mill Creek, now known as Lagunitas Creek, some five miles east of Olema. The building, a wood structure, is of sufficient capacity for all required purposes. The power for driving the machinery is both water and steam. About one-half mile above the mill a dam has been constructed across the Creek from which the water is conducted to the mill in a flume. The engine is 100 horsepower and is used in summer time when water power is exhausted.

"Employment was given to 20 hands who received from $30 to $50 per month. They manufactured books, news, brown wrapping (hardware) and manila paper and the capacity of



Photo No. 1

Two views of completed war surplus bridge across Lagunitas Creek in Samuel P. Taylor State Park in Marin County

the mill was about 20 tons of paper per month.

"During the year of 1867 the mill manufactured 380 reams of colored paper, 3,500 reams of news and book, 9,250 reams of manila, and the value of the total product was $64,800."

The March 28, 1862, issue of the *California Farmer*, a San Francisco paper, has an article describing the mill, as follows: "The works are carried by water power. The main wheel is 30 feet in diameter with 15-foot buckets and very heavy iron lugs. Another wheel is 24 feet in diameter with 6-foot buckets. To Mr. Taylor great praise is due to his zeal and energy in thus perfecting such an enterprise and

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Photo No. 2

Effect of Freeway Development on Adjacent Land Values in California

By FRANK C. BALFOUR, Chief Right of Way Agent

THIS is the first installment of a paper read by Frank C. Balfour, Chief Right of Way Agent, California Division of Highways, before the Right of Way Committee of the American Association of State Highway Officials at the thirty-third annual meeting of the association in New York City, September 22-26.

BEFORE it is possible for me to discuss the topic assigned to me for presentation before this committee—"Effect of freeway development on adjacent land values in California"—it is imperative that I attempt at least for the moment to clear up the confusion that exists between the several state highway departments because of the wide and varied terminology we are using in the several sections of the Nation to describe the same type of highway improvement.

Perhaps it would be well for us to give some serious thought to the crossword puzzle we have created in the minds of the public, a puzzle which should be obvious to you, when it is necessary for the Right of Way Agent representing one of the states to carefully qualify the terminology he uses in presenting his subject today so that all of us assembled here may understand that when I refer to a freeway I am referring to the modern type of highway improvement in some states called a freeway, in others a throughway and in still others an expressway, a controlled access highway, a superhighway, or perhaps some other newly-coined term that has not yet come to my attention.

FREEWAY DESCRIPTION

For the purpose of this study, the legal description in my State of the type of highway to which I am referring, is as follows:

"'Freeway' means a street or a highway in respect to which the owners of abutting lands have no right or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access."

For the purpose of clarification in the presentation of the subject, when I refer to the Arroyo Seco Parkway, I use the term "parkway" for the reason that the Arroyo Seco extending from Los Angeles to Pasadena through most of the distance is constructed through park lands of the Cities of Los Angeles, South Pasadena and Pasadena, and in the main the abutting properties are set aside for recreational facilities for the general public.

LIMITED FREEWAY

When referring to a limited freeway, I am referring to a highway on which access is controlled and to which the abutting properties may or may not have access to the through lanes of traffic at locations reserved at the time the access rights were acquired, with the width of such openings for access restricted in the conveyance of such access rights, and a highway on which intersecting cross streets and roads may cross at grade or where grade separations may be provided.

A freeway is a highway on which there is positively no access from abutting properties to the through lanes of traffic. There may or may not be outer highways constructed to supply access to abutting properties for the convenience of the neighborhood through which the freeway passes. A freeway is a highway on which all intersecting cross streets or roads cross the freeway on grade separations or on which such intersecting cross streets may be deadended at their intersection with the freeway through the creation of cul-de-sac streets.

I feel it is very important for all of us in state highway right of way acquisition work, perhaps through the medium of the AASHO Sub-Committee on Right of Way, to immediately enter into an extensive program of research work for the purpose of determining as soon and as early as possible and on a broad scale, the definite answer to the question—"What is the effect on abutting and contiguous land values when freeways and limited freeways are constructed?"

In a determined effort to learn the answer, we in the California State Highway Right of Way Department are presently carrying on such a program of research work. Unfortunately, however, our progress has been slow because our first concern has been to keep out of the way of the steam shovel and the grader, but we are determined to get the answer to this important question and to this end we are working.

ARROYO SECO PARKWAY

California's first parkway, the Arroyo Seco, was opened to traffic on January 1, 1941, and is presently being extended a distance of about one and one-half miles from a point adjacent to the north end of the central business district of Los Angeles to a meeting with the Santa Ana, Hollywood and Harbor Freeways at the huge distribution structure we refer to as the "four-level structure," just westerly of and toward the north end of the central business section of the city.

I have previously stated that most of the alignment of the Arroyo Seco Parkway passes through park lands of the Cities of Los Angeles, South Pasadena and Pasadena. However, a very limited section of the parkway is abutted by private lands. The market value of these abutting parcels is in general from three to twelve times more today than was their market value in January, 1941. It is, of course, conceded that a goodly portion of this tremendous increase in value has been due to the fact that the metropolitan area of Southern California has been blessed—or maybe I should say cursed—with the greatest voluntary immigration of population in the history of the world during the period 1941 to 1947 and there has been a huge in-



This photograph was taken looking west on Arroyo Seco Parkway in South Pasadena

crease in the size of the industrial area of Los Angeles and its immediate surroundings.

PROPERTY VALUES ENHANCED

However, I believe it is a fair statement that privately-owned properties fronting on the outer highway along the westerly side of the Arroyo Seco Parkway in the City of Los Angeles between Avenue 53 and Avenue 64, have enhanced in value from 1½ to 3 times as a direct result of construction of the Arroyo Seco Parkway.

It is a little more difficult to determine the effect of construction of the Arroyo Seco Parkway through sections which are abutted by private property in South Pasadena, for the reason that the Parkway alignment through this city is constructed in a furrow ent approximately 20 feet below the elevation of the privately-owned properties, but it is the opinion of qualified real estate brokers and top members of the real estate appraisal profession that the construction of this parkway has resulted in a very definite uptrend in the value of abutting and contiguous private real estate holdings. They are, however, reluctant to say how much of the 200 to 400 percent increase in real estate values in the South Pasadena section since 1941 can be definitely credited to this major highway improvement. **(See photographs No. 1 and No. 2, for views of Arroyo Seco Parkway.)**

It is my frank opinion that the only possible study of effect of freeway development on adjacent land values available at this time where accurate information can be secured, is perhaps right here in the metropolitan area of New York and along the completed section of the Pennsylvania Turnpike.

NORTH SACRAMENTO FREEWAY

Out in California we are presently completing construction of the North Sacramento Freeway, a major project which takes Federal Routes 40 and 99-E around the City of North Sacramento. Construction is also in progress on the Eastshore Freeway extending from Vallejo through Richmond, past the East Bay Distribution Structure of the San Francisco-Oakland Bay Bridge and thence on through Oakland, San Leandro and Hayward to an ultimate terminus in San Jose; on the Bayshore Freeway extending from the San Francisco terminus of the San Francisco-Oakland Bay Bridge southerly through South San Francisco, San Mateo, Redwood City and Palo Alto, skirting San Jose and terminating several miles south of San Jose, from which point it will extend on southerly as a limited freeway. Also approximately 285 miles further south on this same route, U. S. 101, portions of the Rancheria Freeway are under construction from a point north of Santa Barbara to a point south of that city.

HOLLYWOOD FREEWAY

We are now under construction on the Hollywood Freeway carrying U. S. 101 from a point in the upper San Fernando Valley into the heart of

the metropolitan area of Los Angeles where it terminates at the four-level distribution structure; on the Santa Ana Freeway which starts at this distribution structure and extends southeasterly where it rejoins the present U. S. 101 southerly of the City of Santa Ana; and on the Harbor Freeway which starts at the same distribution structure and extends southerly to the San Pedro-Long Beach harbor area. I have previously stated that we are now working on the extension of the Arroyo Seco Parkway to join the three freeways at the four-level distribution structure.

The Cabrillo Freeway is presently under construction extending northerly from the heart of the business district of San Diego to a point northerly of the city.

BIG FREEWAY PROGRAM

There is also under construction additional short sections of freeway and completed or under construction a number of limited freeway sections. As a result of the Collier-Burns Highway Act which was passed by the 1947 Session of the Legislature, a very heavy program of freeway and limited freeway construction will be carried on over a period of years with the result that it is a conservative estimate that during the coming 10 years we will have a total of well in excess of 800 miles of freeways including limited freeways in operation in our State and California is only one of a number of states facing a similar heavy program.

It follows that we have an obligation to our citizens as a whole and especially to the property owners who will be affected, to take any necessary steps, regardless of how difficult, through proper study and research to definitely determine the effect of freeway development on adjacent land values. It is my sincere hope that before our committee meetings here in New York are over, the distinguished speaker who will appear before us and discuss this matter as to the parkway and freeway system in New York will get us off to a flying start on this phase of the proposed vitally necessary research work.

I feel much better qualified to present the portion of the subject assigned to me that refers to limited freeways, and here permit me to pause to explain that under the general plan in California our most important north and south state arterials such as U. S. Routes 99 and 101, and our most important east and west arterials such as U. S. 40, 50 and 60, will gradually be converted into limited freeways in the rural areas, and will pass through the urban and metropolitan areas as freeways.

MULTIPLE-LANE DIVIDED

Under our plan the limited freeway is always a multiple-lane divided highway with two lanes in each direction and with additional lanes added as traffic increases and makes three lanes in each direction necessary. When you realize the length of California from the Oregon line to the Mexican border and the width from the metropolitan areas of San Francisco, Los Angeles and San Diego to the Arizona-Nevada border, you will appreciate the fact that there will be many hundreds of miles of limited freeway constructed in our State during the coming 10-year period.

I refer in my presentation to five- and ten-year periods because the Collier-Burns Highway Act of 1947 sets up specific five-year periods during which certain phases of our tremendously expanded highway construction program will be carried on.

In general and, perhaps, to the surprise of some of you assembled state highway right of way representatives, it is my definite opinion that in the great majority of cases the taking of access rights from the abutting property on a controlled basis when you are converting an existing conventional type of highway facility into a limited freeway, represents a nominal damage.

One of many attractive sections of Arroyo Seco Parkway between Los Angeles and Pasadena





Park-Presidio Boulevard in San Francisco. Looking north from Fulton Street

I, of course, concede that the limiting of access to an abutting property represents a definite damage but I contend that the benefits to the abutting property well offset this damage, granting, naturally, that in many of the states, because of the laws under which you operate, the benefit as a strictly legal matter may be a general and not a special one. Nevertheless, I repeat that the actual decrease in market value of a specific piece of abutting property will be more than offset by the financial benefit that will actually accrue to the market value

This is another view of Park-Presidio Boulevard through residential section of San Francisco





Junipero Serra Boulevard in San Francisco showing two outer highways

of the particular piece of property. From the experience we have already had in California, I feel that I have the factual information to prove that my opinion is correct.

Before presenting to you statistical information on individual parcels of land that have been affected by limited freeway construction in California, where actual sales have taken place, and prove the correctness of the opinion I have formed, I would like a few minutes of your time to discuss limited freeways on a general basis.

Long before our State Highway Department embarked on the program of planning and constructing limited freeways, planners and subdividers with outstanding foresight were thinking along the same lines and transformed their thoughts into action and accomplishment.

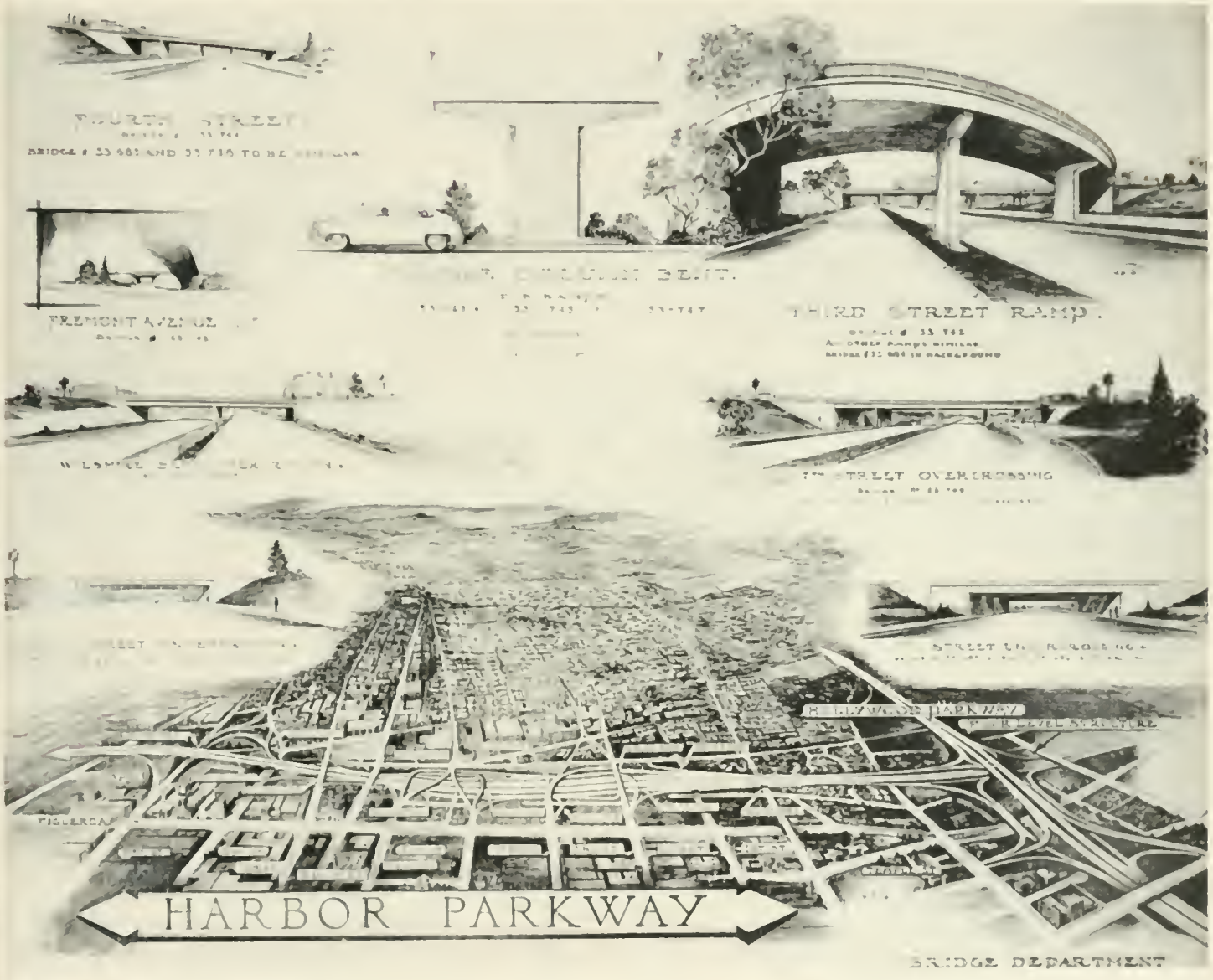
I cite Park-Presidio Boulevard in the City of San Francisco where the

(Continued on page 34)

Showing residential property development on Junipero Serra Boulevard



Harbor Parkway Is Under Construction



THE HARBOR PARKWAY, now under construction in the City of Los Angeles, will be one of the four major traffic arteries radiating from the four-level grade separation structure at the intersection of Hollywood Parkway, Arroyo Seco Parkway and Harbor Parkway.

This photograph of a composition drawing by Van der Goes of the Bridge Department of the Division of Highways shows the proposed location and various structures from Olympic Boulevard to Temple Street.

An attempt has been made to retain some of the lines common to structures now designed or contemplated for other parkways, all in connection with the four-level structure, so as to give the completed network a simple but dignified appearance.

Bridge Engineer Stewart Mitchell Honored By A.S.C.E.

Stewart Mitchell, senior bridge engineer, State Division of Highways, Sacramento, has been appointed to a five-year term as a member of the executive committee of the Structural Division of the American Society of Civil Engineers.

The committee heads all activities of this technical division of America's oldest engineering organization.

Under direction of this committee, papers in the field of structure will be prepared for presentation at society meetings, and through it, all structural activities will funnel.

THE CALIFORNIA Highway Commission on November 13th adopted and approved for transmittal to Governor Warren, a budget for the fiscal year July 1, 1948, to June 30, 1949, calling for the expenditure of $73,938,000 on major highway construction projects. This amount includes cost of right of way and engineering.

In line with its announced policy to convert U. S. 40 from Sacramento to San Francisco to a four-lane divided highway, the commission made provision for the four-laning of all but 10 miles of existing two-lane roadway on this route. When improvements contemplated on the new budget are completed, there will remain only the sections of U. S. 40 from Cordelia Junction to the proposed Fairfield By-pass and from the east side of the by-pass to Vacaville to be widened to four lanes divided.

The budget authorizes a project to four-lane U. S. 40 from one-fourth mile west of Napa County line to Cordelia Underpass and from Ledgewood Creek to 3.5 miles east of Fairfield, estimated to cost $2,018,000. This means the by-passing of Fairfield to relieve serious traffic congestion on U. S. 40 through Fairfield and will convert the present two-lane roadway on the American Canyon Cut-off to a four-lane divided highway. This item, as do all others in the budget, includes the cost of engineering and right of way.

Long needed improvement of portions of the Black Point Highway from Ignacio in Marin County to the Sonoma County line will be undertaken at an estimated cost of $375,000, which will provide for a new bridge and the widening, grading, and surfacing of 3.6 miles of roadway.

For engineering, rights of way, and construction the commission authorized expenditure of $2,319,000 for the underpass under the Southern Pacific railroad tracks in Roseville and the grading and surfacing and widening of U. S. 99E from Roseville to two miles north of Andora Subway.

MAJOR CONSTRUCTION PROJECTS IN STATE HIGHWAY BUDGET FC

County	*Route*	*Description*	*Approximate mileage*	*Estimated cost including engineering and right of way*
Alameda	5 (US 50)	Toll Plaza, grade, pave and toll facilities	---	$377,000
Alameda	5 (US 50)	Station 640 to 1½ miles west of Livermore, grade and structures	3.6	855,000
Alameda	69 (SR 17)	Oak Street to 38th Avenue, grade and pave	3.7	4,200,000
Alameda	69 (SR 17)	Centerville Union High School to Davis Street (portions), surface	6.8	252,000
Alameda	69 (SR 17)	42d Avenue Interchange, grade, pave and structures	---	1,930,000
Alameda	69 (SR 17)	Elmhurst, Damon, East Creek Slough, structures	---	420,000
Alameda	227	Route 75 to Park Boulevard (portions), JHD No. 26, grade, pave and structures	2.3	315,000
Amador	34 (SR 88)	Cooks Station to easterly boundary, grade and surface	7.0	189,000
Amador	97	Dry Creek, bridge and approaches	0.3	54,000
Butte, Sutter	3 (US 99)	Lomo Crossing to Fagan (portions), surface	7.0	105,000
Butte	3 (US 99)	Nelson to Butte Creek, surface	3.3	40,000
Butte	3 (US 99)	Chico to north county boundary (portions), surface	11.8	204,000
Calaveras	24 (SR 12)	Valley Springs to San Andreas (portions), surface	3.5	123,000
Contra Costa	14 (US 40)	Hercules to Oleum (portions), grade and pave	1.5	135,000
Contra Costa	75 SR 24	Line Change to Old River Bridge and Brentwood to San Joaquin County Line (portions), grade and surface	1.6	137,000
Contra Costa	106 (SR 4)	Berry Hill line change, grade and pave	1.6	358,000
Contra Costa	107 (SR 21)	Alameda County Line to Danville (portions), surfacing	4.9	292,000
Fresno	4 (US 99)	Selma to Fowler, fences and barriers (outer highways)	---	17,000
Fresno	4 (US 99)	Belmont Circle to Clinton Avenue, grade and pave	1.9	333,000
Fresno, Madera	4	Herndon to ¼ mile north of San Joaquin River, bridge	---	510,000
Glenn	45 (SR 45)	Sacramento River Overflow and Campbell Slough, bridge repair	---	107,000
Humboldt	1 (US 101)	North Scotia Bridge to 16th Street in Fortuna (portions), grade and surface	8.0	926,000
Humboldt	1 (US 101)	2.6 miles to 7.6 miles north of Orick, base and surface	5.0	224,000
Humboldt	46	Perch Creek, grade and culvert	1.0	$97,000
Imperial	12, 27 (US 80)	San Diego County Line to Arizona State Line, redeck bridges	---	143,000
Imperial	27 (US 80)	East Highline Canal, bridge and approaches	0.5	128,000
Imperial	198 (SR 78)	Mile 8.2 and Mile 8.3, structures and approaches	---	23,000
Imperial	201, 187 (SR 111)	East of Heber to Brawley (portions) and Curlew Station to Brawley (portions), surfacing	6.0	115,000
Inyo	23 (US 6, 395)	In Bishop, drainage	---	68,000
Kern	4 (US 99)	Grapevine to Switzers, surfacing	19.6	462,000
Kern	4 (US 99)	Hoskins Road to Brundage Lane, grade, pave and signals	4.9	908,000
Kern	4 (US 99)	Snow Road to Cowelo, fencing and barriers	2.8	77,000
Kern	23 (US 6)	Ittners to Ricardo (portions), grade and surface	0.7	78,000
Kern	57 (SR 178)	Bodfish Creek, bridge	---	13,000
Kern	57 (SR 178)	Canebrake Creek, bridge	---	25,000
Kern	58 (US 466)	Mojave to San Bernardino County Line (portions), grade and surface	10.0	156,000
Kern	58 (US 466)	East of Tehachapi, grade and surface (cooperative project with city and railroad)	---	35,000
Kern, Tulare	129 (SR 65)	Route 4 to Ducor, seal coat	23.3	30,000
Kern	139	Kern River, redeck bridge	---	17,000
Kern	140 (US 399)	Buena Vista Creek, bridge	---	21,000
Kern	140 US 399)	Mile 6.53 to Route 4, surfacing	4.4	145,000
Kern	140	Through Arvin, grade and surface (cooperative project with county)	0.7	48,000
Kern	142	Granite Canyon, bridge and approaches	0.5	38,000
Kings	125 (SR 41)	Stratford to Route 10 (portions), grade, surface, and structures	4.9	309,000
Lake	15 (SR 20)	Essential Products Cattlepass, structure	---	12,000
Lake	89 (SR 29)	Middletown to Kelseyville (portions), grade and surface	---	60,000

For a project in Plumas County from Rock Creek to Belden on State Sign Route 24, $1,003,000 is budgeted, and in Shasta County on U. S. 99 from the south county boundary to Anderson, improvements aggregating $795,000 will be made.

To complete the improvement of State Sign Route 1 in Santa Cruz County from Watsonville to Santa Cruz, the sum of $1,631,000 is budgeted for the freeway from Rob Roy Junction to Morrisey Avenue in Santa Cruz.

On the proposed Eastshore Freeway in Alameda County, $4,200,000 is budgeted for grading and paving 3.7 miles from Oak Street to 38th Avenue in Oakland and on the Bayshore Freeway in San Francisco, $5,788,000 is set up for grading, paving, and structures from Augusta Street to Army Street.

Two other items provide $1,930,000 for the 42d Avenue interchange in Oakland, and $420,000 for Elmhurst, Damon, and East Creek Slough bridges on the Eastshore Freeway.

On U. S. 101 in Santa Barbara County $725,000 is budgeted for grading, surfacing, and structures from Santa Ynez River to Jonata Park, a major unit of the Buellton project.

Other notable items in the budget are:

Grading, paving and structures on U. S. 99 north of Atwater to Livingston in Merced County, $669,000; and $210,000 for grading and surfacing four miles of State Sign Route 140 from Gustine to Merced; $5,000,000 for grading and structures on the Hollywood Parkway from Alameda Street to Vermont Avenue; $1,531,000 for grading, paving and structures on the Santa Ana Parkway, Vancouver Avenue to Hoefner Avenue in Los Angeles; $1,174,000 for grading, paving, and structures on U. S. 101 from San Marcos Creek to Agua Hedionda in San Diego County; and $1,259,000 for grading and structures on U. S. 395 from Miramar to Lake Hodges, San Diego County; $1,725,000 for grading, paving, and structures on U. S. 99 from Alamos Creek to Route 59, in Los Angeles County. The budgeted projects follow:

NE HUNDREDTH FISCAL YEAR FROM JULY 1, 1948, TO JUNE 30, 1949

County	*Route*	*Description*	*Approximate mileage*	*Estimated cost including engineering and right of way*
Lassen	29 SR 36	East Westwood Road to Susan River, surfacing	14.1	$103,000
Los Angeles	2 US 101	Hollywood Parkway, Alameda Street to Vermont Avenue (portions), grading and structures	3.6	5,000,000
Los Angeles	2	Hollywood Parkway, Vermont Avenue to Highland Avenue, structures	3.5	2,800,000
Los Angeles	2 US 101	Santa Ana Parkway, Also Street to Eastman Avenue, landscaping and illumination	4.2	435,000
Los Angeles	2 US 101	1.5 miles easterly to 1.6 miles westerly of Malibu Junction, grade, pave, and structures	3.1	1,042,000
Los Angeles	4 US 99	Alamos Creek to Route 59, grade, pave, and structures	10.8	1,725,000
Los Angeles	4, 79 US 99	Through Newhall Ranch, Junction Route 79 to 0.4 mile south of Castaic Creek, grade, pave and structures	2.8	870,000
Los Angeles	19 US 60	White to Garvey, grade and pave center strip	0.5	63,000
Los Angeles	23 US 6	Lancaster to Kern County Line, surfacing	8.1	79,000
Los Angeles	23 US 6	Junction Route 79 to Solamint, surfacing	4.9	94,000
Los Angeles	26 US 60	Willard Avenue to Mountain View (portions), and through El Monte, surfacing	6.4	170,000
Los Angeles	60 US 101	Las Flores Canyon to Malibu Creek, grade, pave, and structures	2.7	726,000
Los Angeles	60, 158 US 101	Lincoln Boulevard and Sepulveda Boulevard (portions), grade and pave		635,000
Los Angeles	61 SR 2	Angeles Crest Highway (portions), grade and surface, prison labor		397,500
Los Angeles	77	San Bernardino Road to Junction Route 26, grade, pave, and structures	1.1	575,000
Los Angeles	79	Saugus to Junction Route 4, surface	2.5	30,000
Los Angeles	165 US 6	Harbor Parkway, Adobe Street to San Pedro, alteration of city streets	23.5	150,000
Los Angeles	166 US 101	Santa Ana Parkway, Vancouver Avenue to Hoefner Avenue, grade, pave, and structures	0.5	1,531,000
Los Angeles	168 SR 19	Lakewood-Rosemead Boulevard, Firestone Boulevard to Beverly Boulevard, grade, pave, and structures	5.6	780,000
Los Angeles	168 SR 19	Rosemead Boulevard, Beverly Boulevard to Garvey Avenue, grade, pave and structures	4.0	$1,165,000
Los Angeles	168 SR 19	Rosemead Boulevard, Langdon Avenue to Huntington Drive, grade, pave, and structures	1.2	320,000
Los Angeles	170 SR 35	Junction Route 174 to Junction Route 178 (portions), surface	2.0	45,000
Los Angeles	174 SR 10	Junction Route 167 to Roseerans (portions) and approaches to Los Angeles River Bridge, grade and pave	4.7	500,000
Los Angeles	205 US 66	In Pasadena and South Pasadena, State Street and Fair Oaks Avenue (portions), grade, pave, and structures, new ramp connections to Arroyo Seco Freeway		144,000
Madera, Fresno	4 US 99	Herndon to ¼ mile north of San Joaquin River, bridge		510,000
Marin	1 US 101	Iznacio to Sonoma County Line (portions), surface	2.3	112,000
Marin	8 SR 37	Ignacio to Sonoma County Line (portions), grade, surface and structures	3.6	375,000
Mariposa, Tuolumne	110 SR 132	Coulterville Westerly, grade and surface	8.5	30,000
Mendocino	1 US 101	3 miles south to one mile north of Rattlesnake Summit, base and surface	4.0	140,000
Mendocino	56 SR 1	St. Ores Creek, grade, surface and culvert	0.5	109,000
Mendocino	56 SR 1	Big River, bridge repair		90,000
Mendocino	56 SR 1	Virgin Creek, grade, surface and culvert	0.5	77,000
Merced	4 US 99	Southerly Boundary to Black Rascal Canal, barrier posts	9.0	7,000
Merced	4 US 99	North of Atwater to Livingston grade, pave and structures	6.5	669,000
Merced	122 SR 140	Gustine to Merced (portions), grade and surface	4.0	210,000
Modoc	73 US 395	Route 28 to State Line (portions), grade prison labor	33.8	315,000
Mono	40 SR 120	Park Boundary to Poole Plant Road, surface	8.9	60,000
Mono	40 SR 120	Sheep Corral to Adobe Creek, surface	16.0	70,000
Mono	95 US 395	Coleville to State Line (portions), grade and surface	2.8	141,000

SR = State Sign Route.

County	Route	Description	Approximate mileage	Estimated cost including engineering and right of way
Monterey	2 (US 101)	San Ardo to King City (portions), surface	3.0	$225,000
Monterey	56	Salmon Creek, bridge and approaches	0.1	113,000
Monterey	56	Prewitt Creek, redeck bridge		18,000
Monterey	56 (SR 1)	3 cattlepasses, replace		22,000
Monterey	56 (SR 1)	Del Monte Junction to Seaside Junction, curbs and landscaping	2.4	62,000
Napa, Solano	7 (US 40)	¼ mile west of Napa County Line to Cordelia Underpass and Ledgewood Creek to 3½ miles east of Fairfield, grade and pave	8.7	2,018,000
Napa	74, 8 (SR 21) (SR 12)	Kelly Curve to Glass House, curve and connection to Napa Wye, grade and pave	2.5	305,000
Orange	43 (SR 18)	Santiago Boulevard to Peralta School, grade, pave and structures	5.0	1,399,000
Orange	60 (US 101)	Seal Beach to Junction Route 43 (portions), surface	2.6	78,000
Orange	60 (US 101)	Junction Route 43 to east city limits of Newport Beach, near Irving Street, widening	0.7	108,000
Orange	178 (SR 18	Santa Ana River, bridge and approaches	0.6	427,000
Placer	3 (US 99)	Roseville to two miles north of Andora Subway, grade, surface and S.P.R.R. underpass in Roseville	3.1	2,319,000
Plumas	21 (SR 24)	Rock Creek to Belden, grade and surface	3.7	1,003,000
Plumas	83 (SR 89)	Sulphur Creek, bridge and approaches	0.4	63,000
Riverside	26 (US 60)	Edom to 2.9 miles north of Indio, surface	7.4	96,000
Riverside	43 (US 91)	Corona to 0.5 mile east, bridge and approaches	0.5	198,000
Riverside	64 (US 60)	Junction Route 146 to Blythe, surfacing	3.±	181,000
Riverside, San Diego	77 (US 395)	Escondido to Murietta (portions), grade and drainage (prison labor)	6.0	451,000
Riverside	146 (SR 195)	Imperial County Line to Ripley, bridges		61,000
Riverside	187 (SR 111)	0.1 mile to 0.5 mile east of Cathedral City at Rocky Point, grade and surface	0.4	85,000
Riverside	193	Belgrade Avenue to Route 19, surface	3.0	69,000
Riverside	194 (SR 83)	Massacre Creek (Potrero Creek), bridge and approaches	0.1	20,000
Sacramento	11 (US 50)	One mile west of Nimbus to railroad crossing near White Rock	5.0	760,000
Sacramento	54 (SR 16)	½ mile west to one mile east of Slough House, grade, surface and structures	1.6	241,000
San Benito, Santa Cruz	67	0.2 mile west of Pajaro River to 0.4 mile east, grade, surface and bridge	0.6	188,000
San Bernardino	9 (US 66)	Los Angeles County Line to San Bernardino (portions), surface	9.4	235,000
San Bernardino	31 (US 91) (US 395)	Through San Bernardino, South City limits to Highland Avenue, widen and surface	4.0	206,000
San Bernardino	31, 58 (US 91) US 66)	Barstow to Nevada State Line, and Barstow to Needles, redeck bridges		108,000
San Bernardino	59 (SR 2)	One mile east of Cajon to Junction Route 188 (portions), grade	2.8	19,000
San Bernardino	77 (SR 71)	Merrill Avenue to Pipe Line Avenue, bridge and approaches	0.6	347,000
San Bernardino	190	Base Line Road to Orange Street, grade, pave and bridge	1.5	354,000
San Bernardino	207	0.7 mile east of Plunge Creek to Long Point, grade, surface and structures	1.8	831,000
San Diego	2 (US 101)	San Marcos Creek to Agua Hedionda Creek, grade, pave and structures	4.4	1,174,000
San Diego	77 (US 395)	0.5 mile north of San Diego to Junction Murphy Canyon Road, surface	2.9	50,000
San Diego	77 (US 395)	Miramar to Lake Hodges (portions), grade and structures	10.±	1,259,000
San Diego, Riverside	77 (US 395)	Escondido to Murietta (portions), grade and drainage (prison labor	6.0	451,000
San Diego	77 (US 395)	Three miles south of Riverside County Line to County Line, surface	3.±	82,000
San Diego	77, 198 (SR 78)	6.4 miles west of Ramona to Julian (portions), grade and surface	1.6	218,000
San Diego	195	East and West Channels Live Oak Creek, bridges and approaches		$32,000
San Francisco	68 (US 101)	Augusta to Army, grade, pave and structures	1.2	5,788,000
San Joaquin	75 (SR 4)	Old and Middle Rivers, redeck bridges		92,000
San Luis Obispo	2 (US 101)	Deleissigues Creek to Russel Turn, surfacing	2.4	175,000
San Luis Obispo	33 (SR 41)	Rocky Creek, bridge and approaches	0.1	25,000
San Luis Obispo	56 (SR 1)	San Luisito and San Bernardo Creeks, widen bridges		58,000
San Luis Obispo	125 (US 466)	Salinas River, bridge repair		30,000
San Mateo	56 (SR 1)	Half Moon Bay to Montara (portions), JHD No. 9, grade and pave	4.±	355,000
San Mateo	105 (SR 17)	Half Moon Bay to Pilarcitos Creek (portions), surface	2.8	85,000
Santa Barbara	2 (US 101)	Santa Ynez River to Jonata Park, grade, surface and structures	3.9	725,000
Santa Barbara	2 (US 101)	0.7 mile east of Arroyo Quemado to .05 mile west of Arroyo Hondo, grade and surface	2.4	756,000
Santa Barbara	2 (US 101)	Sheffield Drive to San Ysidro Road, grade, and surface (outer highways)	1.5	186,000
Santa Barbara	56 (SR 1)	Lompoc to Las Cruces (portions), surface	6.0	225,000
Santa Clara	68 (US 101)	Gish Road to Route 5, surface	0.5	51,000
Santa Cruz	56 (US 101)	Rob Roy Junction to Morrissey Avenue, grade and pave	7.7	1,631,000
Santa Cruz, San Benito	67	0.2 mile west of Pajaro River to 0.4 mile east, grade, surface, and structure	0.6	188,000
Shasta	3 (US 99)	South County Boundary to Anderson, grade, surface and structures	5.0	795,000
Shasta	28 (US 299)	Montgomery Creek to Burney Valley, (portion), surface	16.0	84,000
Siskiyou	3 (US 99)	Gazelle to 6 miles north, (portion), surface	5.3	102,000
Siskiyou	72 (US 97)	Cougar to 3.4 miles south, surface	3.4	42,000
Solano, Napa	7 (US 40)	¼ mile west of Napa County Line to Cordelia Underpass and Ledgewood Creek to 3½ miles east of Fairfield, grade and pave	8.7	2,018,000
Sonoma	1 (US 101)	0.3 mile south to 1.7 miles north of Santa Rosa, grade, pave, and structures	4.3	2,585,000
Sonoma	51 (SR 12)	Laguna De Santa Rosa and Purple Draw, bridge widening, grade and pave approaches	0.4	72,000
Stanislaus	4 (US 99)	Keyes to Salida, barrier posts	11.3	59,000
Stanislaus	13 (SR 120)	Oakdale to easterly boundary (portions), resurface and line change	11.8	284,000
Stanislaus	41 (SR 33)	Newman to northerly boundary (portions), surfacing	6.0	105,000
Sutter, Butte	3 (US 99)	Lomo to Fagon (portions), surface	7.0	105,000
Trinity	20 (US 299)	Willow Creek to Whites Bar (portions), grade and surface (prison labor)	15.2	300,000
Tulare	4 (US 99	One mile south of Tipton to Tulare Airport, grading and structures	7.8	1,258,000
Tulare, Kern	129 (US 65)	Route 4 to Ducor, seal coat	23.3	30,000
Tulare	133	Cutler Bridge over St. Johns River, bridge and approaches	1.0	165,000
Tuolumne, Mariposa	110 SR 132)	Coulterville westerly, grade and surface		30,000
Ventura	60 (US 101)	South City Limits of Oxnard to junction Route 2 near El Rio, grade, pave and structures and widening of El Rio Underpass	4.0	600,000
Ventura	138 (US 399)	North Fork Matilija Creek, bridge and approaches	0.2	70,000
Yolo	7 (US 99)	Putah Creek to Zamora (portions), surface	13.2	36,000
Yolo	87 (SR 24)	Woodland to Knights Landing (portions), surface	10.9	30,000

SR — State Sign Route.

Fifty Percent of U. S. Highway 99 in District X Is Four-Lane Divided Roadway

By C. J. TEMBY, Assistant District Engineer

ONE HUNDRED and one miles of U. S. Highway 99, State Highway Route 1, extends through San Joaquin and Sacramento Valleys from the southerly boundary of Merced County to the northerly boundary of San Joaquin County within the limits of District X.

Thirteen miles of this route is through 10 incorporated cities which are continuously connected by U. S. Highway 99; namely, Merced, Atwater and Livingston in Merced County; Turlock, Ceres and Modesto in Stanislaus County and Ripon, Manteca, Stockton and Lodi in San Joaquin County. In addition to these incorporated cities, several unincorporated towns are also connected by this route. Vehicular traffic on this important main state highway artery has been continuously increasing.

The average daily traffic on this portion of U. S. 99 has increased approximately 75 to 80 percent in the last 10 years. The present truck traffic on this highway is about 22 percent of the total volume of traffic.

CONTINUING IMPROVEMENT

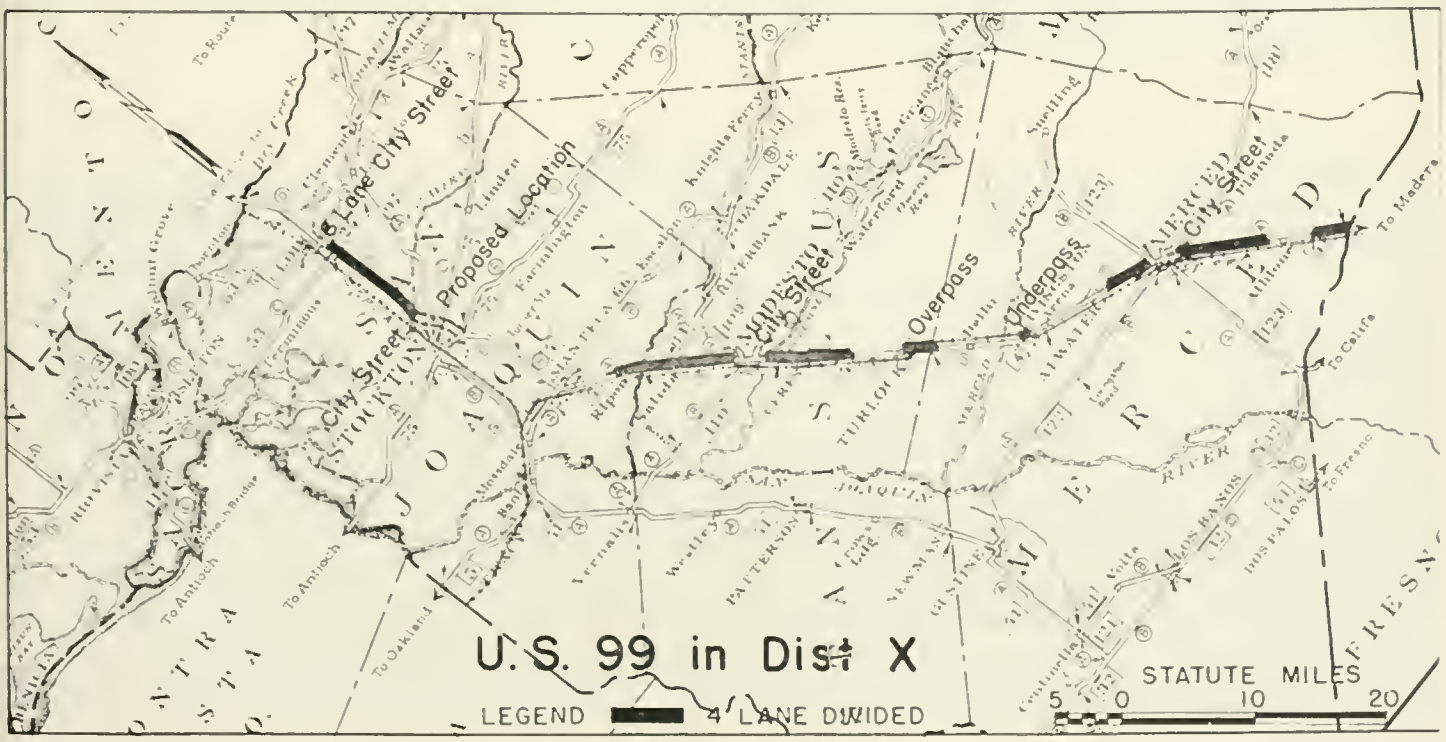
The Division of Highways, recognizing this tremendous traffic volume increase and the resulting congestion, has improved as many miles as revenues warranted, replacing the two-lane traveled way with additional traffic lanes, the first of such work being in 1931 when the existing two-lane highway from Stockton to Old Cherokee Station via Cherokee Lane in San Joaquin County was replaced by a new highway on new location between the same termini via Wilson Way.

A portion of this, about 1.2 miles in length, from the northerly city limits of Stockton to the diverting canal, was constructed on a 46 foot roadbed width, with Portland cement concrete pavement 30 feet wide, providing for three 10 foot lanes. In 1938, the first divided four-lane unit was constructed between Modesto and Salida, a total length of approximately 5.8 miles.

The divided four-lanes are the result of constructing a new roadbed and pavement generally parallel to and with the pavement centerline located at a distance far enough away from the centerline of the original pavement to provide an unpaved medium strip between the inside edges of the pavement lanes. Upon completion of the construction on this design, two lanes of traffic are routed in one direction only over the old two-lane pavement and two lanes of traffic are permitted to travel in the opposite direction on the two new lanes of pavement.

VARIABLE ROADWAY WIDTHS

Variable pavement separation distances have been provided from a general average of 20 feet between edges of pavement on the first construction project to 36 feet between the inside edges of the pavement on the latter constructed projects. Likewise, vari-





Four-lane divided highway and outer highway on left approaching Salida from south. Note wheel tracks of illegal crossing of divisional strip. Concrete barrier posts will be erected at this location

able right of way widths for these improvements have been provided.

The latter projects have been constructed on right of way widths having a minimum of 160 feet with the centerlines of the two lanes of pavements spaced 60 feet apart. An exception to this right of way development plan is used where the project is parallel to the railroad right of way where the distance between railroad right of way and the centerline of the highway is reduced by 10 feet, thus resulting in a minimum full width of right of way of 150 feet. On the most recent projects the plans were developed and rights of way acquired on the limited freeway basis.

To date, with the recent completion of a project between Black Rascal Canal and Buhach Station in Merced County, a distance of 3.8 miles in length, District X has constructed approximately 40.2 miles of divided four-lane highway on U. S. 99 highway outside the limits of incorporated cities and has expended for the additional lanes required to provide the four-lane divided feature, a total of approximately $3,750,000 for construction purposes only.

In addition to this, approximately $400,000 has been expended on three-lane portions and $200,000 for widening and improving through incorporated cities. Several additional thousands of dollars have been expended by the various incorporated cities on portions of U. S. 99 in their respective cities. The work has all been performed under contract and consisted in the main part of grading, select material bases, subgrade treatment and pavement.

The cost of the work has varied from $37,000 per mile in 1938 to $110,000 per mile in 1947. This increased cost per mile of construction is partially due to higher unit prices bid by contractors and partially to improved designs, the improvement in designs being dictated from experiences and better knowledge of soil conditions and a better scientific approach to correc-

Divided four-lane highway at Buhach, Merced County, showing county road intersection channelization with raised bar island and cross-over between traffic lanes





Upper—Traffic using two-lane bridge across Stanislaus River between Salida and Ripon, San Joaquin County. Bridge for additional two lanes to provide four-lane divided highway shown under construction on right.
Lower—Twin bridges on four-lane divided highway north of Merced



Governor Earl Warren's Highway Commission. These men have mapped a long-range program to convert major highway routes into four-lane divided highways. Left to right: Homer P. Brown, Placerville; C. Arnholt Smith, San Diego; James Guthrie, San Bernardino; Director of Public Works C. H. Purcell, chairman; Harrison R. Baker, Pasadena; F. Walter Sandelin, Ukiah; Chester H. Warlow, Fresno.



Four-laned divided highway between Stockton and Lodi. Walnut trees between pavement lanes provide natural barrier and enhances esthetic appearance

tions of adverse soil conditions based on proper engineering studies. The unit prices bid for construction items has advanced.

A comparison of a few of the major items are about as follows: Roadway excavation $0.25 to $0.30 per cubic yard in 1938 and $0.50 to $0.60 per cubic yard in 1947; structure excavation $1 per cubic yard in 1938 and $1.70 to $2 per cubic yard in 1947; Class "A" Portland cement concrete pavement $7.25 per cubic yard in 1938 and $11 per cubic yard in 1947; Class "A" Portland cement concrete structures $23 per cubic yard in 1938 and $45 to $50 per cubic yard in 1947. These expenditures do not include any costs for rights of way, preliminary or construction engineering.

Two railroad track separation structures for four-lane highways have been constructed, one being a highway underpass of the Southern Pacific Company's tracks at Livingston and the other a highway overpass of the Southern Pacific Company's tracks immediately south of Turlock. Several new bridges and drainage structures have been constructed.

ABOVE FLOOD LEVEL

At several locations, the old two-lane highways have been inundated during peak flood periods. With the construction of additional roadbed to provide for the divided four-lanes, the new roadbed has been located on the upstream side of the existing pavement and constructed to an elevation above flood level with adequate drainage openings provided to result in all-year dry riding pavements.

In addition to the 40.2 miles of four-lane divided highways outside the limits of incorporated cities there has been constructed 2.4 miles of three-lane pavement. Through the City of Lodi approximately 0.6 of a mile, full width city street is constructed, being 76 feet between curbs, and provides for six 10 foot traveled lanes and two 8 foot parking lanes.

With the constantly increasing traffic, it is the desire of the Highway Department to complete all of U. S. Highway 99 to a divided four-lane standard as rapidly as money can be made available for such work.

There is in the present budget, an item for grading and structures of four-lane divided section on a limited access freeway right of way on new location for a portion of U. S. Highway 99 in San Joaquin County between Mariposa Road and Calaveras River, a distance of 5.3 miles. This proposed project is referred to and known as the Stockton Through Route.

New Pacific Coast Highway Will Be Portion Of Terminal Island Freeway

By G. L. LAIRD, Associate Bridge Engineer

A PORTION of the existing Pacific Coast Highway, U. S. 101, formerly known as State Street, is being developed as a freeway. The section under development extends a distance of 0.7 miles and lies in the Wilmington district of the City of Los Angeles and in the City of Long Beach. This development is an integral part of the Terminal Island Freeway Access Road Project.

The structures included in the development of the 0.7 miles of freeway consist of a bridge over the official channel of the Los Angeles Flood Control, now called Dominguez Channel, and grade separation structures over the tracks of the Los Angeles City Harbor Department, the Union Pacific Railroad tracks, and the Terminal Island Freeway.

The entire Terminal Freeway Project was divided into seven sections, and bids were called for early in 1946. Contracts for the construction of the approaches and the Cerritos Channel Bridge, between Seaside Boulevard and Station 57, were awarded by the Navy and are being constructed under Navy supervision. The remainder of the project is being constructed under five separate contracts awarded by the Division of Highways.

Contracts awarded were as follows:

1. Cerritos Channel Bridge	$5,200,000
2. Approaches Cerritos Channel Bridge	340,000
3. Terminal Island Freeway Highway, Sta. 57 to Willow Street	1,141,000
4. Union Pacific R.R. Overhead	599,100
5. Anaheim Street Undercrossing	849,400
6. Nicholson Avenue Overcrossing	264,300
7. Pacific Coast Highway	1,672,300
Total amount contract awards	$10,066,100

Of the one and two-thirds million dollar cost of the Pacific Coast Highway project, approximately 55 percent is for the four bridge structures and the redecking of the Texas Company's pipe line subway.

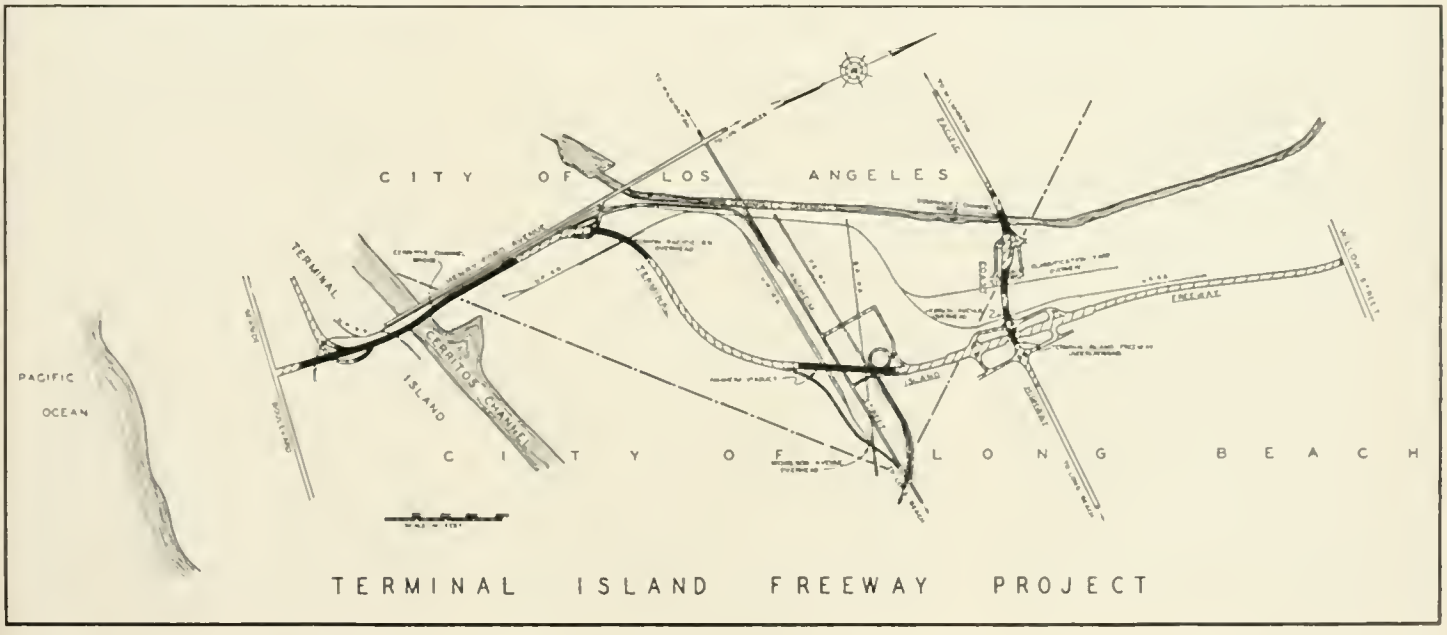
The new Pacific Coast Highway Freeway will be built to carry six 12-foot traffic lanes, three in each direction; roadways will be of asphaltic concrete pavement, separated by a six-foot safety division strip. Additional widths provide for accelerating and decelerating lanes at interchange ramps.

Interchange roadways are designed for "Cloverleaf" operation at the intersection of Pacific Coast Highway and Terminal Island Freeway. Interchange roadways have also been provided to serve the City of Los Angeles Harbor Department property and warehouse installations.

The relatively high embankments between overhead structures are built upon earth subject to subsidence and required the installation of vertical sand drains.

Ground settlement tapered off very rapidly upon completion of fills and after seven months has practically reached a standstill. An accelerated settlement of about 0.20 feet took place during the driving of steel H-piling for the bridge abutments. Immediately after completion of pile driving settlement practically ceased adjacent to abutments.

In anticipation of some lateral movement and uneven settlement of the ground, the special provisions stipulated that no bridge bents adjacent to the fill would be built until fills were completed. At bents of the Hobson Avenue and the Classification Yard structures adjacent to the maximum fills, a maximum horizontal movement of one inch was noted. No appreciable movement occurred at the other bridges where the approach fills were not as high.



TERMINAL ISLAND FREEWAY PROJECT



Terminal Island Freeway undercrossing looking east along State Street (Pacific Coast Highway)

The three grade separation structures (Classification Yard Overhead, Hobson Avenue Overhead, and Terminal Island Freeway Undercrossing) are all similar in design and construction. The intermediate bents consist of six 3-foot square reinforced concrete columns spaced at 16- to 21-foot centers, supported by through concrete footings bearing on untreated Douglas fir piles. The reinforced concrete abutments rest on top of the approach fills and are supported by 12-inch steel H-piling, 62 to 75 feet in length. The timber and the steel H-piling, driven to the same bearing value, penetrated to approximately the same tip elevation although the steel piles were driven through an added 25 to 36 feet of fill.

The superstructures with spans varying from 48 to 60 feet in length have concrete deck slabs supported by rolled WF girder sections.

While the design of these bridges is fairly simple, the short distances between the structures necessitated the widening for the various acceleration and deceleration lanes to occur on the structures themselves. This, together with changes in superelevation to accommodate these ramps, caused some complications both in construction and calculations. As an example, the Hobson Avenue Bridge is 152 feet in length with the centerline on a curve of 1,600-inch radius. The west end of the bridge is 113 feet wide while the east end is 137 feet. The south gutter has three compounded curves not concentric with the centerline while the north gutter has two. The surface of the deck is broken up into four planes which provides for the varying slopes of the roadway and ramps.

As there were no alternate routes within any reasonable distances by which traffic could be routed around the work, construction operations for the new bridge over Dominguez Channel had to be restricted to part-widths. The southerly portion of the main bridge was constructed first and traffic routed over it. Work on the adjoining portion of the main bridge and the ramp bridge is under way.

Footings for piers for the Dominguez Channel Bridge were constructed at an elevation of minus 16 feet in order to allow for possible future dredging of the channel. In construction of the footings for the south half of bents 2 and 3, the contractor decided to use a well point system for keeping the excavation dry. This system was only partially successful due to a number of reasons, chief of which was probably the limited space available for placing points around the excavation. The necessity of having the well points so near the excavation defeated their purpose, since the water was not allowed sufficient time to collect at the points before it seeped into the excavation. Cofferdams, constructed of steel sheet piling were resorted to and are expected to be used exclusively on the north half.

The piers and abutments of this bridge are similar in design and construction to the grade separation structures. However, the longer spans necessitated the use of built-up, plate girders 72 inches deep. These girders are spaced at approximately 16-foot centers and support a reinforced concrete deck slab 9¾ inches thick.

Traffic was diverted from the old road and detour on October 28, 1947, to the south roadway of the new freeway, using this 36-foot roadway for temporary two-way traffic. It is expected that the remainder of the work will be finished and the completed freeway in operation by April 1948.

The new freeway was designed under the supervision of F. W. Panhorst, State Bridge Engineer and S. V. Cortelyou, District Engineer. The construction is under the supervision of Frank B. Cressy, District Construction Engineer, W. D. Eaton, Resident Engineer; and G. L. Laird, Bridge Department Representative. James I. Barnes Construction Company of Santa Monica, California, is the Contractor.

Terminal Island Freeway Structures

By J. M. CURRAN, Associate Bridge Engineer

TWENTY air miles south of the City of Los Angeles, lies Terminal Island. A freeway is now being constructed which will eventually extend from Terminal Island north to the intersection of the Long Beach Parkway and the Los Angeles River Parkway.

The section of the Terminal Island Freeway from Seaside Boulevard on the island to Sepulveda Boulevard on the mainland is now being constructed. Early completion of this section is desirable to alleviate traffic conditions on the few outlets from the island to the mainland.

This project was originally initiated by the Federal Government in 1940-1941 as a part of the defense program to provide access to the U. S. Fleet Operating Base on Terminal Island and is now being constructed to provide access to Terminal Island as a permanent Naval Base.

TRAFFIC CONGESTION

Now, as during the war, there are but three means of vehicular entrance or exit from the mainland to the island. At the easterly end of the island is a small pontoon bridge of a temporary nature built for war time use only; at the westerly end of the island there is a ferry; and at the northerly end of the island there is a Henry Ford Boulevard bascule bridge.

During any hour of the day traffic is heavy in this area. During the shift changes of industries on the island, traffic becomes extremely dense and hazardous.

The new freeway will cross Cerritos Channel, a navigable waterway separating the island from the mainland, with a vertical lift bridge. This structure with its approaches is being constructed by the U. S. Navy Department.

About 2,500 feet north of the Cerritos Channel, the Navy section ends and the state section begins. The State supervised construction on the freeway proper consists of a roadway contract under District VII and three Bridge Department contracts. The roadway contract begins just north of the Cerritos Channel and extends northerly, under reconstructed U. S. 101, to Willow Street or Sepulveda Boulevard.

STATE BUILDS STRUCTURES

The Bridge Department contract includes an overhead structure over the Union Pacific Railroad Cerritos yards; an overhead structure continuous over the Union Pacific Railroad Meade Transfer yards, Anaheim Street, the Southern Pacific Railroad tracks, the Pacific Electric Railroad tracks and newly constructed I Street; and an off-ramp and structure over the Union Pacific Railroad, Southern Pacific Railroad and The Atchison, Topeka and Santa Fe Railway tracks.

A difficult and expensive task of clearing right of way and moving and revising existing utilities had to be performed prior to and during construction. On the Union Pacific Railroad Company's oil field property, through which the freeway passes, over $300,000 was spent on moving office buildings, shops, relocating tracks, removing and relocating oil pipe lines, and relocating overhead power lines. A submarine power cable was relocated beneath Cerritos Channel. North of Anaheim Street, pipe lines were moved and power lines relocated or raised to clear the roadway.

POWER LINE TOWERS RAISED

Included in these operations were the raising of 200 Kv. 6-wire tower lines and the 60 Kv. 36-wire tower lines of the Southern California Edison Company. The towers were raised 15 feet without interruption to service by cutting the tower legs, jacking them up to the required position and splicing in new sections of tower.

First of the state supervised structures on the freeway is the Union Pacific Railroad Overhead which crosses over five storage or classification yard tracks and one spur track of the Union Pacific Railroad, spans a private road and the ramp roadway of the freeway off-ramp which serves the area including the Ford Motor Company assembly plant.

The Union Pacific Railroad Overhead is a steel girder structure with reinforced concrete deck, concrete columns and concrete footings supported on untreated timber piles. The structure is 965 feet 3 inches long, consisting of thirteen 74-foot 3-inch spans and two 63-foot 5-inch spans. There are two 35-foot roadways with a 4-foot dividing strip and concrete curbs. The superstructure is practically two separate bridges each supported on three steel girders with an expansion joint placed longitudinally along centerline of deck. Column footings are continuous across the two structures.

DESIGN OF OVERHEAD

The structure is designed entirely on a 1,350-foot radius curve and a uniform 5 percent superelevation. The bents have a uniform skew off the radial lines, and span lengths are 74 feet 3 inches with alternate spans continuous over two bents, supporting the adjacent spans by hinged connections.

Untreated timber piles were used for pier foundations. Abutment footings rested on the approach fills and were supported on steel piles. All substructure concrete was completed well in advance of structural steel delivery.

Structural steel was delivered by rail to the site. Steel girders were unloaded from the cars, placed on trucks and hauled to proper position in the structure. The American Bridge Company subcontracted the furnishing and erecting of structural steel and used a special built 50-ton crawler crane with a 70-foot boom to erect the girders, the maximum weight of which was 18 tons. A smaller crane followed up with the placing of diaphrams, expansion dams and lighter members. Field riveting was limited to the diaphrams.

A steel railing is to be erected on the bridge and provisions are being made for future street lighting.

This structure was completed November 15, 1947, six months after the original contract completion date. Structural steel delivery for this structure, as with others of this project, was delayed approximately six months thus accounting for the completion date delay.



Looking along Terminal Island Freeway toward Los Angeles and Terminal Island Freeway undercrossing

The Union Pacific Railroad Overhead structure was designed by the Bridge Department of the Division of Highways, Macco Corporation is the General Contractor, J. E. McMahon started the contract as Resident Engineer, but on assuming other duties, was replaced by J. M. Curran as Resident Engineer.

NICHOLSON AVENUE OVERHEAD

Just before reaching the Anaheim Street Overhead, an off-ramp from the Terminal Island Freeway leaves the main freeway, travels easterly to cross the Union Pacific Railroad and Southern Pacific Railroad on an overhead grade separation structure, and then descends to meet Anaheim Street at grade in the City of Long Beach.

The Nicholson Avenue Overhead is on the off-ramp of the freeway. The off-ramp is a one-way road carrying traffic from Terminal Island to the Long Beach area and will be heavily traveled when the existing U. S. Navy Department pontoon bridge is abandoned.

Included in this project was construction of the separation structure, construction of roadway approach fills, retaining walls and construction of a 48-inch drain across Anaheim Street and under the Pacific Electric tracks.

ONE-WAY STRUCTURE

The Nicholson Avenue Overhead is a one-way structure 28 feet wide between concrete curbs, 573 feet long and consists of one railroad span 86 feet long, seven intermediate spans 55 feet long and two end spans 49 feet long.

The superstructure consisting of a reinforced concrete deck resting on structural steel beams is supported on reinforced concrete two-column bents.

A 7 percent grade on the east approach and a 5 percent grade on the west approach is connected on the structure with a 700-foot vertical curve. A 600-foot radius curve on the

Looking north toward Classification Yard overhead which is on left. Hobson Avenue overhead is in center foreground and Terminal Island Freeway undercrossing on right



easterly three spans and 600-foot radius curve in the opposite direction on the westerly spans with six spans of tangent between create a continuously warping surface with superelevation or cross slope rates ranging up to 6 percent.

Substructure design was similar to that of the Union Pacific Railroad Overhead.

All substructure concrete was completed well in advance of structural steel delivery. Concrete was deposited in footing and column forms with a ¾ c.y. concrete bucket, raised with a crane and deposited through hoppers to forms.

Structural steel beams were delivered by rail to the site. The American Bridge Company subcontracted the furnishing and erecting of structural steel. Similar to other structures on this freeway, the spans were hinge connected.

Lateral displacement of end bents was anticipated at this structure and construction of Bents 2 and 10, end bents, was deferred until after completion of approach fills and surcharges. However, accurate measurements failed to show any lateral or vertical structural movement due to forces imposed by the surcharge approach fills.

A steel railing was erected on the bridge and provision was made for future street lighting.

In addition to the structure, approach fill construction was included in the project. Though heights of approach fills were limited to 25 feet, sand drains or sand piles were installed beneath the fills to stabilize them. From actual borings made in the field, a suitably firm subterranean structure was selected upon which to found the sand drains. The stratum decided upon was a sandy formation at approximately 40 feet below the ground surface.

The Nicholson Avenue Overhead and approaches were completed September 26, 1947, but are not yet open to public traffic and will not be opened until completion of the Cerritos Channel Bridge.

Nicholson Avenue Overhead was designed by the Bridge Department, Division of Highways and the roadwork by District VII. Oberg Brothers were the General Contractor and J. M. Curran the Resident Engineer.

ANAHEIM STREET OVERHEAD

The most northerly structure to carry the freeway is the Anaheim Street Overhead. This overhead structure carries the freeway over oil field roads, over six tracks of the Union Pacific Railroad Company's Meade Yards, over heavily traveled Anaheim Street in the City of Los Angeles, over the Southern Pacific Railroad Company's Long Beach main line tracks, over the double tracks of the Pacific Electric Railway's Long Beach line and over newly constructed I Street which feeds the on-ramp to the freeway at this location.

Anaheim Street Overhead is 1,511 feet long containing 21 spans and consists of two roadways separated by a 4-foot dividing strip. There is an on-ramp to the west roadway. The east roadway which will carry north bound traffic, is 26 feet wide between curbs and is on tangent for the first two-thirds of its length and then curves westerly on a 3,200-foot radius curve. The west roadway will carry south bound traffic and is 35 feet wide between curbs for most of its length and parallels the east roadway. At the on-ramp entrance, the west roadway widens to 46 feet to provide an accelerating lane.

STEEL GIRDER CONSTRUCTION

The structure is of steel girder construction with concrete decks, concrete column bents and concrete footings supported on untreated timber piles. Spans are of variable lengths ranging from the 49-foot end spans to the 119-foot spans over the railroad and city streets. Most of the spans are 73 feet 6 inches long. At two locations, Bents 13 and 14, structural steel columns

(Continued on page 33)

View of Classification Yard overhead. Dominguez Channel bridge in distance



HIGHWAY BIDS AND CONTRACT AWARDS

September, 1947 (Cont'd)

MENDOCINO COUNTY—Between 57 and 59 miles north of Willits, the existing bridges across Red Mountain Creek and McCoy Creek to be repaired. District I, Route 1, Section K. Sterling Company, Los Angeles, $27,550; Butte Construction Co., San Francisco, $28,485; C. C. Gildersleeve, Douglas City, $31,868; Evans Construction Co., Berkeley, $33,960. Contract awarded to J. H. McFarland, San Francisco, $27,289.

RIVERSIDE AND SAN BERNARDINO COUNTIES—Between Cloverdale Avenue in Riverside County and Valley Boulevard in San Bernardino County, about 6 miles to be graded, surfaced with plant-mixed surfacing, on imported borrow and seal coats to be applied. District VIII, Route 695. Griffith Co., Los Angeles, $175,120; R. A. Erwin & Cee Tee Construction Corp., Puente, $183,479; E. L. Yeager, Riverside, $185,808; T. M. Page, Monrovia, $189,047; Morrison-Knudsen Co., Inc., San Francisco, $196,654; Matich Bros., Colton, $197,341; George Herz & Co., San Bernardino, $203,523; Oswald Bros., Los Angeles, $211,689; Silva & Hill Construction Co., Los Angeles, $223,795; Clifford C. Bong & Co., Arcadia, $225,954. Contract awarded to Peter Kiewit Sons Co., Arcadia, $170,554.30.

SAN BERNARDINO COUNTY—Between City Creek Bridge and 0.7 mile east of Plunge Creek, about 4.3 miles to be graded and surfaced with plant-mixed surfacing, and a bridge to be constructed across East Fork City Creek. District VIII, Route 207, Section A. Bressi & Bevanda Constructors, Inc., Los Angeles, $793,154; Morrison-Knudsen Co., Inc., San Francisco, $920,658; Winston Bros. Co., Azusa, $935,511; Matich Bros. and L. A. & R. S. Crow, Colton, $971,671; J. E. Haddock, Ltd., Pasadena, $987,775; Claude Fisher Co., Inc., Los Angeles, $1,119,341; Guy F. Atkinson Co., Long Beach, $1,238,531. Contract awarded to Westbrook & Pope, Sacramento, $743,959.50.

SAN DIEGO COUNTY—In the City of San Diego, Washington St., Normal St. and El Cajon Blvd. between Balboa Freeway and Texas St., about 1.1 miles to be graded and paved with Portland cement concrete, and dividing islands to be constructed. District XI, Route 12. Basich Bros. Construction Co. and Basich Bros., Alhambra, $227,613; R. E. Hazard Contracting Co., San Diego, $248,742. Contract awarded to Griffith Co., Los Angeles, $197,311.80.

SAN JOAQUIN COUNTY—Across San Joaquin River at Mossdale, the superstructure for a bridge to be constructed and approaches to be surfaced and paved. District X, Route 5, Section B. Lord & Bishop, Sacramento, $451,259; A. Soda & Son, Oakland, $481,859; Fredrickson & Watson Construction Co., Oakland, $482,376; J. H. Pomeroy & Co., Inc., San Francisco, $493,916; Haas & Rothschild, San Francisco, $563,976. Contract awarded to Judson Pacific-Murphy Corp., Emeryville, $416,422.20.

SISKIYOU, TRINITY AND MENDOCINO COUNTIES—Four existing steel bridges across Salmon River, Trinity River, South Fork of Eel River and Greenwood Creek, to be cleaned and painted. District 1, Routes 46, 20, 1, 56, Sections A,D,K,C. Contract awarded to J. H. Mohr, Inc., San Francisco, $20,941.

SISKIYOU COUNTY—Between Camp Lowe and Bailey Hill, about 7.8 miles to be graded, and drainage and irrigation facilities to be installed. District II, Route 3, Section C. Morrison-Knudsen Co., Inc., San Francisco, $666,053; McNutt Bros., Eugene, $737,124; Westbrook & Pope, Sacramento, $757,418; Frederickson Bros., Emeryville, $769,483; H. Earl Parker, Inc., Marysville, $803,282; K. L. Goulter & Co., Seattle, $885,263; A. Teichert & Son, Inc., Sacramento, $933,936; N. M. Ball Sons, Berkeley, $979,475; Natt McDougall Co., Portland, $989,387. Contract awarded to Fredrickson & Watson Construction Co., Oakland, $651,030.27.

SOLANO COUNTY—Construct ferry ramp extensions at Cache Slough Ferry and at Steamboat Slough Ferry near Rio Vista. District X, Routes 99, 100, Sections A, A. H. F. Lauritzen, Pittsburg, $8,561; Wm. B. Willett Co., San Francisco, $8,376. Contract awarded to C. M. Allen, Fairfield, $6,435.

SOLANO COUNTY—Repairing a bridge fender across Napa River at westerly city limits of Vallejo. District X, Route 208, Section A. H. F. Lauritzen, Pittsburg, $7,386. Contract awarded to Duncanson Harrelson Co., San Francisco, $6,644.

YUBA COUNTY—On Ostrom Road between Plumas School and FAS Route 922, about 1.2 miles to be graded, penetration treatment to be applied and two reinforced concrete slab bridges to be constructed. District III, Route 921. Chittenden & Chittenden, Auburn, $112,478; Elmer J. Warner, Stockton, $114,959; Rice Bros., Marysville, $126,514. Contract awarded to H. Earl Parker, Inc., Marysville, $96,515.20.

October, 1947

ALAMEDA COUNTY—Installing drainage pump in underpass. District IV, Route 206. Contract awarded to Archer Equipment Co., Oakland, $1,771.31.

ALAMEDA COUNTY—Over East Shore Freeway and the tracks of the Southern Pacific Company and the tracks of the Western Pacific Railroad Company at 19th Avenue in the City of Oakland, an overcrossing and the southerly approach thereto to be constructed. District IV, Route 69. Stolte, Inc. & The Duncanson Harrelson Co., San Francisco, $361,563; Dan Caputo, San Jose, $372,280; J. H. Pomeroy & Co., Inc., San Francisco, $373,662; A. Soda & Son, Oakland, $373,761; S. J. Amoroso Construction Co., San Francisco, $376,606; Erickson, Phillips & Weisberg, Oakland, $379,150; Fredrickson & Watson Construction Co., Oakland, $379,968; Healy Tibbitts Construction Co., San Francisco, $409,283. Contract awarded to Carl N. Swenson Co., Inc., San Jose, $354,098.80.

BUTTE COUNTY—Across Sacramento River, about one mile east of Hamilton City, the existing steel highway truss bridge to be cleaned and painted. District III, Route 47, Section A. J. H. Mohr, Inc., San Francisco, $12,600; Pacific Bridge Painting Co., San Francisco, $13,703. Contract awarded to Beardsley Painting Co., Los Angeles, $9,856.

IMPERIAL COUNTY—Across New River, a distance of about 0.13 mile, to be graded and bituminous surface treatment applied, and a reinforced concrete slab bridge to be constructed; and across Greeson Wash, a distance of about 0.16 mile to be graded and bituminous surface treatment applied, and a reinforced concrete slab bridge to be constructed. District XI, Route 202, Sections A, B, E, S, & N, S, Johnson, Fullerton, $64,296; Catalina Construction Co., Covina, $71,649; Norman I. Fadel, North Hollywood, $72,268; Troy Construction, Inc., Los Angeles, $72,724; Walter H. Barber, La Mesa, $74,052; The Hogan Co., Riverside, $76,291; Johnson Western Co., San Pedro, $76,670. Contract awarded to George W. Peterson, Los Angeles, $53,198.80.

LOS ANGELES COUNTY—On Hollywood Parkway, at Alvarado Street, in the City of Los Angeles, a reinforced concrete box girder undercrossing to be constructed. District VII, Route 2. Oberg Bros., Inglewood, $346,603; W. J. Disteli, Los Angeles, $354,040; Carlo Bongiovanni, Los Angeles, $355,066; Peter Kiewit Sons, Arcadia, $358,480; Byerts & Dunn, Los Angeles, $358,573; Haddock Co., Pasadena, $359,100; Winston Bros. Co., Azusa, $377,715; Spencer Webb Co., Inglewood, $382,380. Contract awarded to Guy F. Atkinson Co., Long Beach, $346,063.

LOS ANGELES COUNTY—At the intersections of Figueroa Street and Carson Street, Atlantic Avenue and Rosecrans Avenue, and Firestone Boulevard and Garfield Avenue, furnishing and installing full traffic actuated signal systems and intersection illumination. District VII, Routes 165, 167, 174. C. D. Draucker Co., Los Angeles, $35,095. Contract awarded to Econolite Corp., Los Angeles, $33,281.

LOS ANGELES COUNTY—On Harbor Parkway, at Temple Street, in the City of Los Angeles, a reinforced concrete undercrossing and retaining walls to be constructed. District VII, Route 165. Byerts & Dunn, Los Angeles, $359,009; W. J. Disteli, Los Angeles, $360,640; Haddock Co., Pasadena, $360,923; Carlo Bongiovanni, Los Angeles, $368,265; Peter Kiewit Sons Co., Arcadia, $368,958; Guy F. Atkinson Co., Long Beach, $373,186; Winston Bros. Co., Azusa, $387,468; Oberg Bros., Inglewood, $398,824; Spencer Webb Co., Inglewood, $414,648. Contract awarded to James I. Barnes Construction Co., Santa Monica, $357,466.

LOS ANGELES COUNTY—On Whittier Boulevard at Durfee Avenue and on Rosemead Boulevard at Mission Drive, Las Tunas Drive and Huntington Drive, furnishing and installing traffic signals and intersection illumination at four intersections. District VII, Routes 2, 168, Sections D, C, C, D. Draucker Co., Los Angeles, $60,595. Contract awarded to Econolite Corp., Los Angeles, $55,035.

NEVADA COUNTY—Between one and one-half miles north of Rattlesnake Creek and Grass Valley, about 3.8 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 17, Section B. Morrison-Knudsen Co., Inc., San Francisco, $358,122; Fredrickson & Watson Construction Co., Oakland, $360,601; A. Teichert & Son, Inc., Sacramento, $369,545; H. Earl Parker, Inc., Marysville, $392,875. Contract awarded to Fredrickson Bros., Emeryville, $341,522.30.

RIVERSIDE COUNTY—At Santa Gertrudis Creek, about 4 miles north of Temecula, on the Hemet-Winchester-Temecula Road, a reinforced concrete bridge to be constructed and about 0.35 mile of approaches to be graded and surfaced with bituminous surface treatment. District VIII, Route 720.

E. S. & N. S. Johnson, Fullerton, $39,963; A. R. Colleen Co., Corona, $39,088; Haddock Engrs., Ltd., Oceanside, $12,019; O. B. Pierson, Bellflower, $12,300; Geo. W. Peterson, Los Angeles, $12,912; Walter H. Barber, La Mesa, $16,031; Clifford C. Bong & Co., Arcadia, $18,129; Boardman McCain, Inc., Los Angeles, $19,952; Cox Bros. Construction Co., Stanton, $53,611. Contract awarded to Foster & McHarg, Riverside, $36,140.85.

SAN BERNARDINO COUNTY—Between Los Angeles County line and 0.6 mile east of Ontario, about 5.7 miles to be graded and surfaced with plant mixed surfacing on cement treated base. District VIII, Route 19, Sections A, Ont., B, Griffith Co., Los Angeles, $897,564; Matich Bros., Colton, $916,539; United Concrete Pipe Corp. and Jesse B. Smith, Baldwin Park, $945,687; George Herz Co., San Bernardino, $949,983; MacDonald & Kruse-Hensler Construction Corp., Glendale, $955,508; Peter Kiewit Sons Co., Arcadia, $961,017; Dunnitt & Taylor and K. B. Nicholas, Los Angeles, $984,159; J. E. Haddock, Ltd., Pasadena, $1,035,808. Contract awarded to Morrison Knudsen Co., Inc., San Francisco, $872,967.

SAN BERNARDINO COUNTY—At California Institute for Men, 2 miles south of Chino. Surfacing service roads, walkways, driveways, and a parking area. District VIII, R. A. Erwin, Colton, $5,050; Peter Kiewit Sons' Co., Arcadia, $5,275; Herz Paving Co., San Bernardino, $5,094. Contract awarded to Matich Bros., Colton, $4,625.

SAN BERNARDINO COUNTY—In Ontario at the intersection of Route 19 and Euclid Ave., traffic signal system to be furnished and installed. District VIII, Route 19, 192. Tri Cities Electrical Service, Oceanside, $12,130; C. D. Draucker Co., Los Angeles, $13,870; Prescott Electric & Mfg. Co., Los Angeles, $13,985. Contract awarded to Paul R. Gardner, Ontario, $12,033.31.

SAN JOAQUIN COUNTY—Constructing curb and gutter in the City of Tracy on 11th Street between North B Street and Central Avenue. District X, Route 5, F. Kaus, Stockton, $1,924; Tornell Co., Tracy, $4,213. Contract awarded to Charles I. Cunningham, Oakdale, $1,359.25.

SANTA BARBARA COUNTY—Across Nojoqui Creek and Santa Ynez River near Buellton, two structural steel girder bridges to be constructed. District V, Route 2, Section D. Carl N. Swenson Co., Inc., San Jose, $551,705; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $569,175; Macco Corp., Clearwater, $572,811; Norman I. Fabel, North Hollywood, $576,032; Haddock Engineers, Ltd., Oceanside, $608,461; Bent Construction Co., Los Angeles, $618,561; A. Teichert & Son, Inc., Sacramento, $623,028; Winston Bros. Company, Azusa, $630,139; L. E. Dixon Co., San Gabriel, $731,415; Carlo Bongiovanni, Hollywood, $743,318. Contract awarded to C. B. Tuttle Co., Long Beach, $526,031.80.

SANTA CLARA COUNTY—Repairing a bridge across Madadero Creek about 15 miles northwest of San Jose. District IV, Route 68, Section A. J. H. Mohr, Inc., San Francisco, $9,872; Johnson Western Co., Alameda, $11,812. Contract awarded to Emsco of San Francisco, $6,979.08.

SANTA CRUZ COUNTY—Between Rob Roy Junction and Morrissey Avenue in Santa Cruz, about 7.7 miles to be cleared and grubbed, portions to be graded and structural steel and reinforced concrete freeway structures to be constructed. District IV, Route 56, Sections D, E, 8Cr. A Teichert & Son, Inc., & Granite Construction Co., Sacramento, $1,385,525; Guy F. Atkinson Co., South San Francisco, $1,393,557; George Pollock Co., Sacramento, $1,405,994; Parish Bros., Benicia, $1,467,561; Morrison Knudsen Co., Inc., San Francisco, $1,493,694; Fredrickson & Watson Construction Co. & M & K Corporation, Oakland, $1,567,587. Contract awarded to Earl W. Heple, San Jose, $1,373,652.

SHASTA COUNTY—Between junction of Route 3 in Redding and 1.5 miles east, about 1.5 miles to be graded and surfaced with plant-mixed surfacing on crusher run base and the superstructure for a structural steel girder bridge with reinforced concrete deck to be constructed. District II, Routes 3, 20, Sections Rdg, C, Dragline Rentals Co., San Francisco, $666,180; J. H. Pomeroy & Co., Inc., San Francisco, $670,766; S. J. Amoroso Construction Co. & R. A. Farish, San Francisco, $702,715; James I. Barnes Construction Co., Santa Monica, $715,000; A. Teichert & Son, Inc., Sacramento, $731,957; Fredrickson & Watson Construction Co., Oakland, $746,266; George Pollock Co. (A Corporation), Sacramento, $757,478. Contract awarded to Fredrickson Bros., Emeryville, $625,426.96.

SISKIYOU COUNTY—Between Thompson Creek and 1.5 miles east of Beaver Creek. District II, Route 46, Sections B, D. Contract awarded to W. C. Railing, Redwood City, $1,750.

STANISLAUS AND SAN JOAQUIN COUNTIES—Furnishing and installing concrete barrier posts between Salida and one mile north of Ripon. District X, Route 4, Sections B, A, Rip, F. Kaus, Stockton, $11,020; Kiss Crane Co., San Pablo, $25,000. Contract awarded to Evans Construction Co., Berkeley, $9,550.

SUTTER COUNTY—At Live Oak, about 1.7 miles to be graded and plant-mixed surfacing to be constructed on cement treated base and seal coat applied. District III, Route 3, Section L0, A. Harms Bros., Sacramento, $160,923; W. C. Railing, Redwood City, $179,152; Rice Bros., Marysville, $192,284; M. J. B. Construction Company, Stockton, $193,632. Contract awarded to McGillivray Construction Company, Sacramento, $158,471.54.

SUTTER COUNTY—Replace about 180 lineal feet of bituminous surfacing and timber sub-floor on the existing causeway with new reinforced concrete floor. District III, Route 87, Section B, C. C. Gildersleeve, Willows, $12,271; A. L. Miller, Sacramento, $17,550. Contract awarded to William S. Shedd, Yuba City, $12,111.

TEHAMA COUNTY—Across Thomas Creek and across Reeds Creek, about 17 miles and 1 mile south of Red Bluff, respectively, two steel beam span bridges to be constructed and about 0.53 mile of approaches to be graded and surfaced with crusher run base and armor coat applied thereto. District II, Routes 107B and 108Z. Charles MacClosky Co., San Francisco, $194,730; J. P. Brennan, Redding, $195,168; A. Teichert & Son, Inc., Sacramento, $199,232. Contract awarded to G. M. Carr & Bati Rocca, Santa Rosa, $174,743.50.

TULARE COUNTY—About 12 miles northeast of Visalia, the existing bridge across St. Johns River to be reconstructed. District VI, Route 1140. E. S. & N. S. Johnson, Fullerton, $69,878; Taylor-Wheeler Commercial, Inc., Fresno, $69,955; Trewhitt-Shields & Fisher, Fresno, $70,917; R. M. Price Co. & Rex B. Sawyer, Huntington Park, $70,992; Carl N. Swenson Co., Inc., San Jose, $73,336; E. H. Peterson & Son, Richmond, $77,522; Northup Construction Co., Long Beach, $79,811; C. J. B. Construction Co., Oxnard, $83,864. Contract awarded to Charles MacClosky Co., San Francisco, $69,612.

TULARE AND FRESNO COUNTIES—Between 0.5 mile south of Kingsburg and Selma about 5.2 miles to be graded and paved with Portland cement concrete and plant-mixed surfacing. District VI, Route 4, Section E, D, Kugb, A. Guy F. Atkinson Co., South San Francisco, $596,551; R. M. Price Co. & Rex B. Sawyer, Huntington Park, $634,120; Griffith Co., Los Angeles, $639,010; M. J. B. Construction Co., Stockton, $640,961; Fredrickson Bros., Emeryville, $653,867; Fredrickson & Watson Construction Co., Oakland, $655,022; Charles J. Dorfman, Los Angeles, $669,927; Morrison Knudsen Co., Inc., San Francisco, $684,707; A. Teichert & Son, Inc., Sacramento, $686,610; A. G. Raisch Co., San Francisco, $728,727. Contract awarded to N. M. Ball Sons, Berkeley, $593,191.05.

November, 1947

INYO COUNTY—At Shoshone, about 0.7 mile in length to be graded and surfaced with road-mixed surfacing on imported borrow. District IX, Route 127, Sec. N. Arthur A. Johnson, Laguna Beach, $26,635.50; Swedlow Engineering Company, Inc., Santa Monica, $27,405.80; Foster & McHarg, Riverside, $28,886.90; Browne and Krull, Palo Alto, $29,475; Anderson Company, Visalia, $31,877.50; Bishop Engineering & Construction Co., Bishop, $33,008; Dix Syl Construction Company, Inc., Bakersfield, $33,702; Oilfields Trucking Company, Bakersfield, $36,247.30; Geo. E. France Inc., Visalia, $38,338.56; MacArthur & Son, Palmdale, $38,556.50; Laurence M. Schneider, Vista, $39,911; Bainter Const. Co., Long Beach, $39,967.60; Roland T. Reynolds, Anaheim, $41,488.50. Contract awarded to A. A. Edmondson, Glendale, $26,163.50.

KERN COUNTY—Between 15 and 16.5 miles east of Bakersfield, three existing bridges across Walker Basin Creek and Caliente Creek, to be redecked with reinforced concrete. District VI, Route 58, Sec. D. E. S. & N. S. Johnson, Fullerton, $25,816; F. Frolenburg, Temple City, $25,932.50; O. B. Pierson, Bellflower, $26,771.50; Griffith Company, Los Angeles, $27,351.75; L. V. Mulherron, Glendale, $27,552.50; C. B. Tuttle Co., Long Beach, $27,602; E. G. Perham, Los Angeles, $28,901.50; Repsher Brothers, Gen. Contractors, Bakersfield, $36,735.35. Contract awarded to N. M. Saliba Co., Los Angeles, $25,681.

KINGS COUNTY—Between Corcoran and 5.3 miles south, about 5.3 miles in length, to be graded, plant mixed and surfacing to be placed on existing pavement and on crusher run base and bituminous surface treatment to be applied to shoulders. District VI, Route 94B, Geo. E. France, Inc., Visalia, $152,387; R. M. Price Co. and Rex B. Sawyer, Huntington Park, $159,635; Clements & Co., and Browne and Krull, Hayward, $167,745; Elmer J. Warner, Stockton, $169,225; A. Teichert & Son, Inc., Sacramento, $174,290; Claude C. Wood Co., Lodi, $180,818; W. C. Railing, Redwood City, $184,710; Griffith Company Los Angeles, $187,063.50; Brown Doko, Pismo Beach, $210,325. Contract awarded to C. M. Syar, Vallejo, $149,866.80.

LOS ANGELES COUNTY—Ventura Blvd., between Calabasas and 1½ miles westerly, about 2.2 miles in length to be graded and surfaced with plant mixed surfacing on imported base material. District VII, Route 2, Sec. LA-C. Silva & Hill Const. Co., Los Angeles, $316,625.50; Dunnitt & Taylor, Los Angeles, $319,364; Peter Kiewit Sons Co., Arcadia, $323,900; Morrison Knudsen Co., Inc., San Francisco, $327,389.50; J. E. Haddock, Ltd., Pasadena, $331,335; N. M. Ball Sons, Santa Barbara, $332,529.50; Arthur A. Johnson, Laguna Beach, $342,677.50; Griffith Co. Los Angeles, $343,008; MacDonald & Kruse & Hensler Constr. Corp., Glendale, $353,875; C. G. Willis & Sons, Los Angeles, $377,259.50; Clyde W. Wood, Inc., N. Hollywood, $379,971; Frank T. Hickey Inc. & Frank T. Hickey, Los Angeles, $396,688.50; Heuser & Garnett & T. M. Page, Monrovia,

(Continued on page 32)

Eleven Western States Subject of ARBA Study In Expansion Program

LOOKING toward the possible opening of the American Road Builders' Western Association with headquarters in San Francisco, the American Road Builders' Association has retained Floyd O. Booe, of San Francisco, well known in the highway construction field, to conduct a two-months' survey of eleven Western States, Charles M. Upham, engineer-director, announced here today. Booe's report will be presented at the ARBA Highway Conference to be held in Washington, January 26-28, 1948.

Booe's equipment for this job includes 10 years as Secretary of the Nevada Highway Commission and 20 years as Manager of the Northern California Chapter, Associated General Contractors. He has a wide acquaintance among road builders and highway officials in California, Oregon, Washington, Arizona, New Mexico, Montana, Nevada, Wyoming, Colorado, Utah, and Idaho, the states to be surveyed.

Upham explained that because of its distance from the home office in Washington, the proposed association would be autonomous to some extent, while operating closely as a unit of ARBA in matters of policy and administration.

New Bridge Across Rock Creek



THE NARROW, rugged canyon cut by Rock Creek in Mendocino County near its junction with the Eel River, will be spanned by a permanent bridge. The site is on the Redwood Highway, about six miles north of Cummings, and 25 miles south of Garberville.

Traffic has been required to use a temporary timber bridge erected in 1937 when the original timber arch bridge failed. This temporary bridge is located sufficiently off the line of the highway so as not to interfere with the building of a permanent structure. Construction of the new bridge has been delayed by the war emergency and high postwar construction costs.

The new bridge will consist of a concrete deck supported on two continuous steel plate girders, resting in turn on braced steel columns. A 26-foot roadway width, 1-foot 9-inch curb width and concrete railing will be provided. The span between main column supports is 166 feet. There is a center girder span of 66 feet, two side spans of 50 feet, and approach spans of 32 feet 6 inches and 53 feet 6 inches. The total length of the bridge is 256 feet.

This type of bridge is somewhat unique but has several advantages for this particular location. The girders and columns are of simple, straightforward construction. The bridge can be assembled and erected without the necessity of placing temporary supports in the canyon, the bottom of which is 145 feet below roadway grade.

Highway Bids and Awards

(Continued from page 31)

$187,987; Fred D. Chadwick, Lynwood, $521,521.50. Contract awarded to Spicer Company, Los Angeles, $311,630.

MENDOCINO COUNTY—At Navarro River, about four miles south of Albion, a structural steel bridge on reinforced concrete piers and abutments to be constructed and about 0.8 mile of approaches to be graded and surfaced with road-mixed surfacing on imported base material. District I, Routes 48, 56, Sec. C,C.D. Guy F. Atkinson Co., South San Francisco, $427,444.75; Johnson Western Co., Alameda, $532,101; Piombo Construction Co., San Francisco, $558,151.50. Contract awarded to Johnston Rock Co., Stockton, $397,578.50.

MENDOCINO COUNTY—Across Morrison Creek about six miles south of Ukiah, a reinforced concrete bridge to be constructed. District I, Route 979, Northern California Movers and Builders, Ukiah, $16,072.50; T. Feibusch Construction Co., Ukiah, $16,162; Evans Construction Co., Berkeley, $16,666.25; C. C. Gildersleeve, Willows, $16,691; W. Lenkeit Construction Co., San Francisco, $17,910; Reed and Tuttle, Redwood Valley, $20,954; James H. MacFarland, San Francisco, $21,309; Bos Construction Co., Oakland, $21,820; Klay-Bennett Construction Co., Palo Alto, $21,970; Butte Construction Co., San Francisco, $21,999; M. E. Shuper, Stockton, $23,168; O'Conner Bros., Red Bluff, $23,880. Contract awarded to Kenneth Whited, Oakland, $15,819.

ORANGE COUNTY — Across branch of Coyote Creek, about three miles west of Brea, a reinforced concrete slab bridge to be constructed. District VII- Route 176, Sec. A, E. S. & N. S. Johnson, Fullerton, $26,655; Clifford C. Bong & Co., Arcadia, $27,343.24; H. R. Breeden, Compton, $27,633.60; Oberg Bros., Inglewood, $30,729; Catalina Const. Co., Covina, $32,500.50; C. R. Butterfield Co., San Pedro, $33,676; Cox Bros., Const. Co., Stanton, $35,356.50. Contract awarded to O. B. Pierson, Bellflower, $26,140.25.

ORANGE COUNTY—In the City of San Clemente, between San Diego County line and Valencia Street, about 1.8 miles in length to be widened with plant-mixed surfacing on Portland cement concrete base and a portion to be resurfaced with plant-mixed surfacing. District VII, Route 2, Sec. S.Cle. Cox Bros. Const. Co., Stanton, $99,988; Griffith Co., Los Angeles, $125,787.80; Morrison-Knudsen Co., Inc., San Francisco, $155,617. Contract awarded to O'Brien & Bell Const. Co., Santa Ana, $91,044.10.

SACRAMENTO COUNTY — Between North Sacramento Viaduct and Howe Avenue, a highway lighting system to be furnished and installed. District III, Route 3, Sec. B. Scott-Buttner Electric Co., Inc., Oakland, $30,891. Contract awarded to Luppen and Hawley Inc., Sacramento, $29,681.

SACRAMENTO COUNTY—Across Three Mile Slough about 4.3 miles south of Rio Vista, the superstructure for a bridge to be constructed. District X, Route 11, Sec. C. J. H. Pomeroy & Co., Inc., San Francisco, $592,136; A. Soda & Son, Oakland, $598,796.84; George Pollock Co. (a corporation), Sacramento, $619,315.20. Contract awarded to Judson Pacific-Murphy Corporation, Emeryville, $542,914.

Terminal Island Freeway Structures

(Continued from page 29)

were required to provide the necessary horizontal clearance of railroad tracks.

Structural steel girders were shipped to the site by rail and unloaded at the Union Pacific Railroad Meade Yard over which the freeway passes. Trucks hauled the girders to position on the ground where a crane raised them into position in the structure. Except for the 119-foot spans over Anaheim Street and the railroad yards, all girders arrived completely shop fabricated and the maximum weight for these 98-foot long girders was 18¼ tons.

Girders for the 119-foot spans across Anaheim Street and the railroad yards came in three sections. The contractor elected to make the two field splices in each girder on the ground and raise them each in one piece. After splicing, these girders were 157 feet 6 inches long, weighed 42¼ tons and required two cranes to raise them into position.

Kansas City Structural Steel Company furnished the steel and the general contractor erected the steel with his own forces.

COMPLETION DECEMBER 31, 1947

Regardless of the unstable nature of overlying ground formation in this area, there were no vertical or horizontal displacements of end bents due to imposing surcharged approach fill loads adjacent to the abutments of the structure.

The structure will have a steel railing, provision for future lighting and will have aluminum paint for the final coat.

Completion of work on this structure is anticipated for December 31, 1947, three months after the contract completion date. The extended completion date is due to a five months delay in structural steel delivery.

The Anaheim Street Overhead was designed by the Bridge Department, Division of Highways, E. W. Elliott Construction Company is the Contractor and J. M. Curran is the Resident Engineer.

Work covered in these three contracts received a total allotment of $1,981,341.45 allocated as follows:

Union Pacific Railroad Overhead	$679,077.58
Nicholson Avenue Overhead	315,311.67
Anaheim Street Overhead	986,952.20

Completion of all work on Terminal Island Freeway is scheduled for January 1, 1948.



Union Pacific Overcrossing on Terminal Island Freeway

Record Influx Totals Set as Autos Pour Into State

A record-breaking 324-172 out-of-state cars, carrying 942,980 passengers —the greatest three-months' influx in state history—entered California during the third quarter of this year. These totals top by 45,000 cars and 130,000 passengers the previous quarter-year high figures established during 1946.

Ten-month totals also soared to all-time highs this year, with 834,690 "foreign" cars carrying 2,300,605 passengers, entering the State as compared to 783,937 cars and 2,173,473 passengers for the same months of 1946. Touring officials of the Automobile Club of Southern California estimate that nearly 1,000,000 out-of-state cars with 3,000,000 passengers will be checked into California this year by December 31st. The greatest single-month influx of autos into California was registered in August when 120,234 out-of-state cars entered the State.

LEGISLATION SUPPORTS SCHOOL SAFETY PROGRAMS

Two school safety programs, the School Safety Patrols and Driver Education and Training, approved by the 1947 Legislature have become operative. The new law relative to school safety patrols authorizes establishment of safety patrols by any school district, under rules and regulations to be adopted by the State Board of Education. Patrol members are to be selected by school principals with the consent of the students and their parents or guardians.

The law limits activities of the safety patrols to giving signals and directions enabling school pupils to cross streets and highways, but it makes violation of such a signal by a motorist a misdemeanor.

The new driver education and training law authorizes secondary schools to give instruction in this subject.

Effect of Freeway On Land Values

(Continued from page 16)

development is a four-lane divided highway with a wide planted strip on each side, and outside of the plant strip an outer highway to serve the abutting properties. By the very nature of the development, vehicular traffic is not permitted access from the abutting property to the through lanes of traffic except at intersecting cross streets established by public authority. You have only to drive along Park-Presidio Boulevard to realize that this type of development actually enhances rather than depreciates real estate values. You will be convinced of this fact if you drive one or two blocks in each direction from Park-Presidio Boulevard and compare building development and real estate values on the paralleling streets. **(See photographs No. 3 and No. 4.)**

Another typical example is Junipero Serra Boulevard in the city of San Francisco. **(See photographs No. 5 and No. 6.)** From the pictures themselves you can see that the development along Junipero Serra Boulevard, where the abutting property does not have direct access to the through lanes of traffic, is comparable to or of a slightly higher class than the building development you find on the next paralleling streets. Investigation will satisfy you that the front foot value of residential property on this boulevard is more than double the front foot value of residential lots on the next paralleling street.

To Be Continued

War Surplus Bridges

(Continued from page 11)

it is fortunate also that he has an excellent foreman for the mill, Mr. James Watson, one so competent for the business. Here is one of the secrets of success in all the enterprises of the day, faithful and trusty and competent overseers. We are glad to hear that the supervisors of Marin County have made an appropriation to build a bridge over the Creek for it is not very convenient for all travelers to swim in cold weather! It is not every traveler that believes in hydropathy, but as the paper mill is carried by cold water we wish it unbounded success."

Honor Bestowed Upon Two Division Of Highways Bridge Engineers

TWO ASSOCIATE Bridge Engineers of the California Division of Highways have been honored by the trustees of the James F. Lincoln Arc Welding Foundation, who last month bestowed upon them jointly the $1,250 award in the Structural (Buildings and Bridges) Classification of the Design-for-Progress Award Program.

Claud Darby and Geo. W. Smith of Sacramento were co-authors of the winning paper on welded bridges for desert areas. They dealt with prefabricated bridge structures on desert highways to obviate the necessity of hauling concrete materials over long distances.

Previous to joining the Division of Highways, Mr. Darby was in the Navy Civil Engineer Corps and was with the Oregon Highway Commission under G. S. Paxson and the late C. B. McCullogh. He designed the Dr. John McLoughlin Bridge over the Clackamas River, which received the A. I. S. C. award in 1932. He also designed bridges over Alsea Bay, Siuslaw, Umpqua and Rogue rivers, and Cape Creek on the Oregon Coast Highway. He graduated from Oregon State College in 1924. He is an associate member of the American Society of Civil Engineers, the University Club of Sacramento and American Legion Post 61.

Mr. Darby is married and has one daughter attending the University of California, one daughter at Sacramento College and a son who is in high school.

In the 1938 Industrial Award Program sponsored by the foundation, a paper submitted by Mr. Darby received an honorable mention award.

Mr. Smith has been with the Division of Highways since 1928, the last seven years in the Design Section of the Bridge Department and previous to that he was on preliminary surveys and construction. He attended Sacramento High School and Junior College and furthered his technical education with correspondence courses from the University of Wisconsin.

Mr. Smith is an associate member of the American Society of Civil Engineers and a member of the Structural Engineers Association of Central California. He is a registered civil engineer in California. He is married and has two daughters and a son attending Sacramento schools.



Claud H. Darby



George W. Smith

Orange County Completes Its First FAS Project

(Continued from page 34)

A three-inch bituminous treated shoulder of native or imported material six feet in width was included and, where the depth warranted, drainage ditches were graded to a four to one slope.

WIDTH LIMITED BY FUNDS

Current public and technical opinion is not always in agreement as to the desirability of three-lane construction, and in this case traffic volume would, moreover, have justified four-lane construction.

The width of the improvement was limited, however, by two factors: First, there was a disinclination to use nearly all of the county's federal aid allocation for the three-year program on a single project and, secondly, and more important, a great deal of the existing right of way was only sixty feet in width. To have held the project up until the minimum width of 80 feet had been acquired would have resulted in an unreasonable delay.

In the mean time, the county right of way section has been securing as expeditiously as possible, a minimum right of way width of 80 feet. When this has been accomplished, and if funds are then available, the fourth lane may be added.



Looking north on Harbor Boulevard to Garden Grove Boulevard

FEDERAL AND STATE HELP

Both preliminary and construction engineering were handled by the county, and in this connection, acknowledgment is made of the invaluable assistance and cooperation given by federal and state personnel. It is felt here that the excellence of the completed job is due in a large measure to those officials and to the experience and ability of the Griffith Company, Contractors.

The cost of construction, exclusive of engineering, was $240,000, which was financed in whole with federal aid secondary and state matching funds. The cost of work required in connection with right of way agreements was paid for by the county from county funds.

The advantages of this improvement were apparent even before completion—traffic volume jumped ahead on this modern three-lane highway just as it had done when the county first completed the old two-lane road. A 16-hour traffic count, taken on July 13, a month before the project was completed, although it was passable, showed approximately 9,000 cars passed a single intersection. This count was 98 percent higher than the previous high count taken in October of 1945.

The contractor commenced work on this project on February 11, 1947, and all work was completed on August 18, 1947. The construction was under the supervision of the writer, who was represented on the contract by Resident Engineer Allan S. Koch.

This view on Harbor Boulevard is looking north to Bolsa Avenue



Two New Bay Crossings Are In Prospect

(Continued from page 1)

"It is not possible to state at this time the probable amount of money, property, materials, or labor to be contributed from other sources in aid of the construction of the proposed additional crossings, and for that reason such probable amount is hereby stated as none.

"The Department of Public Works hereby recommends to the California Toll Bridge Authority that the additional toll bridge and the additional toll highway crossing, together with their necessary appurtenances and approaches, hereinbefore referred to, be constructed and operated as an aid to, and a part of, the public highways of the State, and as state highways, across the Bay of San Francisco, at the locations hereinbefore specified, and that such bridge and such crossing be constructed and operated by the State of California, pursuant to the provisions of the California Toll Bridge Authority Act, Chapter 176, Statutes of 1947, as amended by Chapter 225, Statutes of 1947.

"The Department of Public Works hereby requests that it be authorized to make necessary surveys and prepare detailed plans, specifications and estimates for such additional bridge and such additional toll highway crossing, and for their appurtenances and approaches, in order that the department may be able to advise your honorable board more accurately of the cost of such construction and of the total amount of revenue bonds which are required to be authorized and issued under said act to meet such costs, and for the purpose of retiring any outstanding bonds and other indebtedness (including indebtedness to the State Highway Fund) secured by a pledge of the tolls and revenues of the existing San Francisco-Oakland Bay Bridge; and further that it be authorized to acquire by gift, purchase, or eminent domain proceedings, in fee or in any lesser estate or interest, any real estate, real property, personal property, franchises, rights, rights of way, easements, or other property, or privileges appurtenant thereto, as may be required for said crossings, their appurtenances and approaches."

In Memoriam

Gustave N. Bergren

THE DIVISION of Architecture, Department of Public Works, deeply regrets the death of Gustave N. Bergren on August 9, 1947, as a result of an automobile accident while on state duty near Hopland, California.

"Gus," as he was known to his friends and associates, was in state service for 28 years and at the time of his death held an important key position with the division in the capacity of Supervising Construction Inspector having charge of construction work over a district area including such institutions as the Napa State Hospital, Sonoma State Home, Veterans' Home, San Quentin State Prison, and as far north as the Humboldt State College.

Born in Sweden, February 15, 1888, he came to the States in childhood. Before entering state service he was in the contracting business with his father under the firm name of L. G. Bergren and Son. For the past seven years he resided in Napa and took an active part in local civic affairs. He was exalted ruler of the Napa Lodge of Elks.

He is survived by his wife, Kathleen, his mother Mary J. Bergren, of San Francisco, and the following sisters: Ethel M. Devoto of San Francisco, Mildred Chisholm of Sacramento and Myrtle Gavigan of San Francisco.

Survey Shows 80 Percent of Highway Trips Are Necessary

Four out of five highway motor trips are still in the "necessary" class, despite the end of gasoline rationing and the tremendous upward surge in motor vehicle usage, according to J. T. Callaway, president of the American Road Builders' Association.

"With an increasing number of vehicles on the highways engaged in necessary travel, and the average motor vehicle traveling almost 10,000 miles a year, speedy attention to our tremendous backlog of highway needs is imperative," Callaway declared.

"Last year, the Nation's drivers piled up a total of 340,655,000,000 vehicle-miles. As new cars and trucks join the 34,000,000 now on our streets and highways, traffic volume, already at its highest peak in history, will make terrific demands on our inadequate transport system."

"For a Nation increasingly dependent upon highway transportation, better roads must be planned, constructed, and maintained. The long-deferred improvement of main highways, county and local rural roads, city and village streets is a necessity."

The Overload Problems on Our Highways

(Continued from page 1)

they entered into cooperative agreements to share the cost on a 50-50 basis with maximum participation based upon the preliminary estimate of cost.

STRATEGIC CONTROL SYSTEM

These above-mentioned scales will provide a strategic system to control the long haul trucks entering or leaving the area, but do not furnish proper or adequate coverage for the intercity movements within the district. In Sonoma County, at Cloverdale, a new lumber mill has recently begun operation. The log hauling from Mendocino County to this mill is developing into a problem. Negotiations are under way with the county toward a cooperative agreement covering their participation in a scale installation near Cloverdale to control the log hauling as well as all other hauling on that portion of U. S. 101.

Scales must also be installed in San Mateo County to cover the movements between San Francisco and San Jose where the volume of commercial traffic is of considerable extent as well as in some other localities where the movements cannot be intercepted by the main line scales.

The control of indiscriminate overloading is vital to the development of the highway system on a long range plan. The rapid deterioration and disintegration of roads, which are adequate for legal loads, long before their economic life is reached can and will disrupt the most carefully planned improvement program.

In addition to the control of damaging overloads, traffic safety is improved by the additional checks which are made on the equipment during the weighing operations. Headlights, taillights, clearance lights, turning signals, brakes, and brake couplings, trailer hitches, and safety chains, and other necessary features can be checked, and if found lacking can be required before the vehicle proceeds.

Thus, the roads are protected from unmerciful beatings imposed by excess loads and the traveling public is protected from the difficulties which can result from defective equipment.

State of California
EARL WARREN, Governor

Department of Public Works
Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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A. H. HENDERSON, Deputy Director

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DISTRICT VII

S. V. CORTELYOU, Assistant State Highway Engineer

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